

K.B. Atkinson
Department of Photogrammetry and Surveying,
University College London

A BIBLIOGRAPHY OF NON-TOPOGRAPHIC PHOTOGRAMMETRY (1976 - 1979)

A bibliography of publications in the field of interest of ISP Commission V has been assembled to cover the immediate inter-Congress period. Despite the reservation that any bibliography is likely to be incomplete, this compilation should assist related research efforts in the immediate future. In addition to the main bibliographical details, each entry carries an abstract of the publication concerned.

It is probably axiomatic that bibliographies are seldom complete. This attempt at providing a bibliography of publications for the period from 1976 to 1979, related to the activities of Commission V of the International Society for Photogrammetry, has undoubtedly left many stones unturned. We must share the responsibility for any omissions because it is imperative that authors should draw our attention to their published work. Relatively few authors have helped in this way and it has been left to the compiler, ably assisted by Mrs. V. Brown and I. Newton, to collect most of the 210 entries and abstracts. In addition to searching primary publications, one of the main sources of information has been Geo Abstracts G, published by Geo Abstracts Ltd., University of East Anglia, Norwich NR4 7TJ, United Kingdom.

The bibliographical entries are arranged in alphabetical order of the title of publication (from Allgemeine Vermessungs-Nachrichten to Zeitschrift für Vermessungswesen), with the addition of the contents of the published proceedings of the ISP Commission V symposium, Photogrammetry for Industry, held in Stockholm in 1978. Each entry is numbered and an alphabetical author index will facilitate cross referencing. It should be noted that some journals, published in late 1979, could not be abstracted in time for inclusion in this bibliography. While providing a record of published work within the Commission's field of interest for the recent inter-Congress period, the bibliography should also serve as a useful starting point for research enquiries in close range photogrammetry. Users of the bibliography should note that the ISP Helsinki Congress papers (1976) have not been included, except where they may also have been published in other sources. No attempt has been made to duplicate the excellent bibliographical coverage of architectural photogrammetry provided by M. Carbonnell (28) in reports of the International Committee for Architectural Photogrammetry. A further source of papers on medical photogrammetry during the period under review is the NATO symposium on applications of human biostereometrics, held in Paris in 1978. Unfortunately, publication was still awaited in January 1980.

A significant event in the development of the Commission's work occurred in 1979 with the publication, by the American Society of Photogrammetry, of the Handbook of non-topographic photogrammetry. The Handbook was edited by former Commission V President, H.M. Karara (64) who was also responsible for the extensive bibliography which is reproduced in Chapter 9. Publication of a second book in this

subject area, by Applied Science Publishers Ltd., entitled Developments in close range photogrammetry and edited by K.B. Atkinson, is expected in 1980. The appearance of these books is symptomatic of the maturity which is gradually being attained by non-topographical photogrammetry.

The compilation and publication of this bibliography was requested and encouraged by Commission V President, K. Torlegård and costs of production have been underwritten by Swedish financial support. Mrs. B.M. Wickens carefully undertook the painstaking work of producing the typescript.

1. Sehr kurze Aufnahmedistanzen bei gewissen Anwendungen in der Kulturgüter-photogrammetrie. (Very short camera-to-subject distances with certain applications of photogrammetry to cultural goods). By G. BOHM and H. FORAMITTI, Allgemeine Vermessungs-nachrichten, 84(1): 24-27 (January 1977).

Use of the SMK 40 camera of Zeiss (Oberkochen), vertical base arrangement, shortening of the camera-to-subject distance by means of auxiliary lenses to 50 cm, description of control point measurements. Tests are described which enable extreme close-range surveys to be undertaken with as short base lengths as are required according to the strict normal case and suitable base ratio.

2. Ein Orientierungs- und Kalibrierungsverfahren für nichttopographische Anwendungen der Photogrammetrie. (An orientation and calibration method for non-topographic applications of photogrammetry). By H. BOPP and H. KRAUSS, Ibid., 85 (5), 182-188 (May 1978).

Based on the linear fractional presentation of the linear transformation equations an exact solution for the orientation and calibration of cameras is derived. The method leads to a least squares adjustment with parameters and additional constraints. The transformation parameters are computed iteratively using three dimensional object space control. With these parameters the object space co-ordinates of all points are determined in a second step.

3. Ein photogrammetrischer Beitrag zur Wiederherstellung der zerstörten Monstranz des Kölner Domschatzes. By W. WESTER-EBBINGHAUS. Ibid., 85(10): 345-350 (October 1978).

In 1976, a monstrance dating from 1657 was stolen from the treasure vault of Cologne Cathedral and destroyed by the thieves. Fortunately, two photogrammetric stereopairs of the monstrance exist so that a reconstruction can be made, using most of the original precious stones, which were recovered. (In German)

4. Biostereometric analysis of surgically corrected abnormal faces. By S. BERKOWITZ and J. CUZZI. American Journal of Orthodontics, 72(5): 526-538 (November 1977).

Stereophotographs of five patients with various craniofacial abnormalities were taken prior to reconstructive surgery in

1972 and again postoperatively in 1973. The subject was positioned in a head reference frame surrounded by three sets of oriented stereometric cameras. Each stereometric camera consisted of a specially designed pair of individual metric cameras and a surface contrast optical projector unit. The frontal and lateral facial views obtained were used to evaluate various facial features. Accurate comparative numerical measurements could be made using soft tissue landmarks.

5. An assessment of a stereophotogrammetric technique for the study of facial morphology in the child. By H.J. AINSWORTH and M.C. JOSEPH. Annals of Human Biology, 3(5): 475-488 (1976).

An assessment has been made of a stereophotogrammetric technique for measuring and contouring the face. Its contouring capabilities depend on the skin surface texture of the subject. Adults have good skin texture and accurate contours can be drawn. Young children cannot be contoured satisfactorily because they lack adequate skin texture and only linear measurements can be obtained with precision. The disadvantage of incomplete facial coverage was eliminated by using a pair of oblique exposures instead of the conventional frontal exposure. The need for mechanical head positioning was avoided by use of a sighting device incorporated in the system to orient each exposure to a common datum.

6. A light-sectioning technique for contouring and measuring a child's face. By H.J. AINSWORTH and M.C. JOSEPH. Ibid., 4(4): 331-341 (1977).

A contouring device for measuring the face was adopted and developed to make it suitable for use with children. Modifications were made to overcome incomplete facial coverage and lack of common head orientation by incorporating the method of optical head positioning previously invented by the authors. The precise alignment of a series of exposures with a common datum enables a set of contour maps to be processed by computer to produce three dimensional measurements and sections of the complete face.

7. Phototheodolite resurvey in the Dry Valleys. By S. MIAGKOV, Antarctic Journal of the United States, 11(2): 96-97 (1976).

The Meserve, Bartley, Sandy, Lower Wright, Taylor, and Rhone glaciers, three glaciers of the Asgaard Group and slopes around the glaciers were resurveyed after a five year interval. No significant changes in the dimensions of the glaciers surveyed twice were noted. The phototheodolite images show movement of up to a few tenths of a metre per year and reveal details of surface movements. Changes in glacier surface elevation above the inner moraines are noticeable and such slope processes as linear flows of over-saturated, fine grained material and massive solifluction movement are noticeable in the Lower Wright, Meserve, and Taylor glacier area.

8. Underwater 35 mm photogrammetry. By J.G. FRYER, M.H. ELFICK and G.A. PEARSON. The Australian Surveyor, 29(7): 461-464 (September 1979).

A photogrammetric technique is being developed for the stereoscopic monitoring and measurement of the marine environment near ocean outfall sewers. A pollution monitoring programme is already being undertaken at Newcastle, New South Wales using an underwater camera to take a single exposure of marine organisms at several test sites. The new technique aims to provide quantitative data for this programme.

9. Zur photographischen Entzerrung abwickelbarer Regelflächen. By K. KRAUS and J. TSCHANNERL. Bildmessung und Luftbildwesen, 44(4): 168-170 (July 1976).

Digitally controlled orthophotoprojectors are capable of rectifying photographs taken from developable surfaces. The author demonstrates that the reference plane normally used in photogrammetry can be replaced by a regularly curved reference surface which offers interesting possibilities for architectural applications. (In German)

10. Zur Leistungssteigerung der terrestrisch-photogrammetrischen Punktbestimmung. By B. WROBEL and K. H. ELLENBECK. Ibid., 45(3): 69-77 (May 1977).

A large amount of information is available in the object space of terrestrial photographs which can be introduced with advantage into point determination procedures of numerical photogrammetry. This paper describes the treatment of measured orientation parameters in bundle block adjustment together with photograph co-ordinates; the analytical formulae required are developed. Accuracy investigations based on an example from architectural photogrammetry are carried out to demonstrate the advantages of introducing additional information into bundle block adjustment. (In German)

11. Photogrammetrische Vermessung des Trockenkühlturms Schmehausen und anschliessende Formkontrolle. By H. BOPP, H. KRAUSS and H.D. PREUSS. Ibid.: 78-81.

A precision survey of a large cable net structure (the cooling tower of a nuclear plant) was performed using high oblique convergent terrestrial photogrammetry with multiple camera stations that were arbitrarily selected. The three dimensional co-ordinates of about 650 points were simultaneously computed and adjusted by means of a general bundle solution. Based on these co-ordinates, the shape of the construction as built was compared with the initial design data. (In German)

12. Neuere Entwicklungen zur Ingenieur-Photogrammetrie. By B. G. MÜLLER. Ibid.: 82-89.

With reference to developments and projects at the Institute for Mining Surveying at Aachen, West Germany, the author examines the possibilities of more intensive application of close range engineering photogrammetry. (In German)

13. Stereo-Photomontagen als Entscheidungshilfe für Hochbauprojekte. By P. WALDHAUSL. Ibid.: 90-93.
This article describes how stereoperspectives can be constructed by means of an analogue plotter such as the Zeiss (Jena) Topocart. (In German)
14. Erdbeneinsatz der terrestrischen Photogrammetrie in Friaul. By H. FORAMITTI. Ibid.: 93-94.
In emergencies, the recording of the actual shape of monuments becomes an essential precondition for the research and maintenance of structures. The author reports on the work conducted by the photogrammetric department of the federal office of monument preservation in the disaster area. The most important experiences with the mission at Friaul (northern Italy) are stated.
15. Projektive Transformation (rechnerische Entzerrung) mit dem Taschenrechner. By R. BURKHARDT. Ibid., 46(2): 47-52 (March 1978).
The process of programming and computing perspective transformation with the aid of sophisticated programmable pocket calculators is described. An example is given of the transformation control points recorded on terrestrial photography of a building. (In German)
16. Photogrammetrische Präzisionspunktbestimmung an einem Hochhaus. By R. D. DÜPPE and K.J. SEEGEL. Ibid., 46(5): 163-170 (September 1978).
High precision engineering control surveys can be implemented by terrestrial photogrammetric methods using a camera with a long focal length with comparable accuracy to that obtainable with conventional geodetic methods and instruments. A survey of a 43 storey building was carried out by both geodetic and photogrammetric methods. As geodetic instruments, the Geodimeter Aga 710 and the Zeiss (Oberkochen) Ni 2 self compensating level were employed. The photogrammetric information was acquired with the ballistic camera Wild BC 4 and the data adjustment was implemented using a newly developed bundle adjustment program. (In German)
17. Photogrammetrische Punktbestimmung durch Bündelausgleichung zur allseitigen Erfassung eines räumlichen Objektes. By W. WESTER-EBBINGHAUS. Ibid., 46(6): 198-204 (November 1978).
Bundle block adjustment is applied to terrestrial photography, taken with a Wild P32 camera, of the Baptistery at Florence. (In German)
18. Bildflug mit ferngelenktem Kleinflugzeug. By H. J. PRZYBILLA and W. WESTER-EBBINGHAUS. Ibid., 47(5): 137-142 (September 1979).
The authors describe the use of a Rolleiflex SLX camera mounted in a radio controlled model aircraft to obtain photography for close range photogrammetry. (In German)

19. Erfahrungen mit der Terrestrischen Messkammer Zeiss TMK 12. By F. JASKOLLA and U. MÜNZER. Ibid.: 149-155.

The Zeiss terrestrial stereocamera TMK 12 is shown to be especially well suited for documenting geological objects, in an Alpine area, at distances of between 1000 m and 2000 m from the camera. If the near range of less than 1000 m is used, very precise tectonic measurements can be derived. In order to obtain the maximum amount of photogrammetric information, the authors recommend that both the TMK 12 and the TMK 6 cameras should be employed. (In German)

20. Calibration and measurement in 3-dimensional monitoring of human motion by opto-electronic means. Part 1. By H.J. WOLTRING. Biotelemetry, 2: 169-196 (1975).

The author discusses the application of analytical photogrammetry to the science of biomechanics, with particular reference to measurements obtained with the use of opto-electronic camera systems.

21. Fotogrametryczne prace Łódzkiego OPGK dla potrzeb archeologii i inwentaryzowania zabytków architektury. (Photogrammetric operations of the Lodz OPGK for purposes of archaeology and inventory of architectural monuments). By J. TYROWICZ. Biuletyn Informacyjny, 22(5): 46-50 (1977).

Description of operations carried out for the inventory of facades and other features with data on the equipment used and the geodetic principles without technical details.

22. X-ray photogrammetry with special reference to the treatment of uterine cancer. By E.B. AGNOLETTO and A.E. SICHIROLLO. Bollettino di Geodesia e Scienze Affini, 35(4): 433-456 (October 1976).

Gynaecological treatment of uterine carcinoma is generally administered by introducing into the patient's body an applicator composed of three divergent probes which contain the active sources. It is extremely important that the precise position of each individual source should be known exactly. The authors have developed a stereo-radiographic procedure for the reconstruction of the geometry of the implant which offers greater precision than the usual method using latero-lateral and antero-posterior radiographs. With the new method, the point is localised with a standard deviation of ± 1 mm, which is quite sufficient for clinical uses.

23. Growth of soft tissues of the face in adolescence. By P.H. BURKE and L.F.H. BEARD. British Dental Journal, 146(8): 239-246 (17th April, 1979).

Growth changes of the soft tissues of the face between the ages of nine years and 16 years were investigated using short base stereophotogrammetry. Three dimensional measurements of ten facial parameters registered in the facial plots gave a measure of facial size for the 26 boys and 26 girls in this mixed cross sectional and serial study. The growth characteristics and sex differences were investigated by calculating

means for the different ages for boys and girls and comparing the pattern with that obtained for means in standing height for the same children.

24. Evaluation of leg ulcer treatment with stereophotogrammetry. By G. ERIKSSON, A. E. EKLUND, K. TORLEGÅRD and E. DAUPHIN. British Journal of Dermatology, 101(2): 123-131 (1979).

The pilot study described in this paper shows that a stereophotogrammetric method is a very suitable and objective method of registration of leg ulcers. The course of the healing process is clearly shown, including small fluctuations which it is not possible to observe clinically. Since the photogrammetric method is convenient for the patient, it provides the possibility of more detailed study.

25. Current principles of morphanalysis and their implications in oral surgical practice. By G.P. RABEY. British Journal of Oral Surgery, 15(2): 97-109 (1977).

The application of morphanalysis to oral surgical problems has been evolving for some 14 years. A recording machine called an analytic morphograph has been developed to obtain X-ray films and Polaroid photographs of frontal, lateral and basal views of the patient's face relative to a fixed reference frame in the form of an electronic cephalostat. A model of the patient's jaw is subsequently made and photographed.

26. Contour photography. By N.R.E. ROBERTSON. British Journal of Orthodontics, 3(2): 105-109 (April 1976).

A method of producing three dimensional photographic records of the human face is described. The equipment uses components which can be easily obtained. It is based on telecentric photography in which projected grid lines are made parallel and divergence errors are eliminated from the recording camera. It is suggested that such records might be of value in orthodontics and in plastic surgery.

27. Contour mapping by light-sectioning. By A.R. WILLIAMS. The British Journal of Photography, 124(6087)(12): 265-266 (March 1977).

Light-sectioning is a method of projecting slits of light on to the subject in order to obtain a "contour map" which can then be photographed. The author has applied the technique to medical subjects.

28. La photogrammetrie architecturale en 1975 et 1976. Rapport du Comité International de Photogrammétrie Architecturale. By M. CARBONNELL. Bulletin de la Société Française de Photogrammétrie, 67: 39 pages (1977/3).

This report on architectural photogrammetry in 1975 and 1976 includes notes on the various conferences held within that period, details of new developments in equipment and methods, a summary of projects carried out throughout the world, with numerous illustrations, and a bibliography. (In French)

29. Terrestrial photogrammetry for measuring pile movements. By M. BOZOZUK, M.C. VAN WIJK and B.H. FELLENIUS. Canadian Geotechnical Journal, 15(4): 596-599 (1978).

Terrestrial photogrammetry was used to monitor movements of previously driven piles during the installation of 116 concrete piles in sensitive marine clay. The technique and the equipment used are described and the sources of error discussed.

30. On-line analytical solutions in close-range photogrammetry. By V. KRATKY. The Canadian Surveyor, 33(2): 177-192 (June 1979).

Close range photogrammetric projects reflect a great variety of diverse conditions which make attempts at a unified solution rather difficult. A degree of uniformity can be established in analytical close range solutions and especially in their on line versions. This is achieved by a suitable formulation of the system functions and by the development of versatile programs which can be readily modified by an operator at the time of their execution. This paper describes a general solution based on these principles and gives practical examples of the program's versatility.

31. Aspects of dimensional control of offshore structures. By M.L. BENNETT. Chartered Surveyor Land Hydrographic and Minerals Quarterly, 3(3): 43-46 (Spring 1976).

The use of non-topographic photogrammetry in the control of dimensions of large offshore structures, needed to extract oil from the North Sea reserves, is discussed in this article.

32. A rapid method of measuring the palatal surface area of cleft palate infants. By A.G. HUDDART, J.J. CRABB and I. NEWTON. The Cleft Palate Journal, 15(1): 44-48 (January 1978).

A method is described for rapidly measuring the surface area of the palate by adapting a piece of soft plastic to a model of the upper jaw using a vacuum moulding technique. The plastic is then flattened under a glass sheet and its area measured with a planimeter. Results of tests on 60 models indicate that, while stereophotogrammetry can measure the surface area of the palate more accurately than can vacuum adaptation, particularly if no cleft is present, it requires a much greater degree of effort and takes longer to carry out.

33. A system for extracting three-dimensional measurements from a stereo pair of TV cameras. By Y. YAKIMOVSKY and R. CUNNINGHAM. Computer Graphics and Image Processing, 7(2): 195-210 (1978).

Obtaining accurate three dimensional measurement from a stereopair of TV cameras is a task requiring camera modelling, calibration and the matching of the two images of a real three dimensional point on the two TV pictures. A system that models and calibrates the cameras and pairs the two images of a real-world point in the two pictures, either manually or automatically, was implemented. This system is operating and provides three dimensional measurement resolution of ± 5 mm at distances of about 2 m.

34. Die photogrammetrische Vermessung der "Roten Halle" von Pergamon. (Photogrammetric survey of the "Red Hall" of Pergamon) By M. STEPHANI, Deutsche Geodätische Kommission, Veröffentlichungen, Reihe B, 216: 127-132 (1976).

The "Red Hall" is a 60 m x 26 m and up to 19 m high brick building from the 2nd century at Pergamon, Asia Minor, on which archaeological research has been conducted by German scientists for more than a century. In spring 1974, this building was surveyed stereoscopically by a small working group of photogrammetrists from Munich with a TAF, a TMK and a P32 camera, as far as possible at scale 1 : 200. The required 4 control points for each photograph were determined by means of intersections and strict adjustment. Stereoscopic plotting at scale 1 : 50 was done on the Zeiss Stereoautograph or on the Stereoplanigraph for horizontally swung photographs; rectification of single photographs on the SEG 1. An orthophotograph was also made as an experiment.

35. Growth of the soft tissues of the middle third of the face between 9 and 16 years. By P.H. BURKE. European Journal of Orthodontics, 1: 1 - 13 (1979).

This paper presents the results of a study on facial growth for a group of like-sexed twins (26 boys and 26 girls) who were observed for varying periods between the ages of nine and 16 years. The study is based on a number of facial parameters which were measured photogrammetrically from photographs taken with a stereoscopic camera formed from a pair of Multiplex projectors.

36. Applikation und Grenzen der Industriefotogrammetrie. (Applications and limits of industrial photogrammetry). By W. RÜGER. Feingerätetechnik, 25(8): 342-343 (1976).

The criteria found for the application of industrial photogrammetry as to object, object size, surface condition, accessibility and variability can be related directly with the characteristics of photogrammetry: adaptation of the photo-scale to the object size taking into account the accuracy requirements; contactless data acquisition by means of photogrammetric survey; simultaneity of data acquisition.

37. Determination of sags in elevator installations by a stereophotogrammetric method. By G.I. MEDVEDEV. Fotogrammetrija v gornom dele, Sverdlovsk, 3: 46-51 (1976).

Proceeding from the relative magnitude of the permissible pitch of such installations, a formula was derived for the calculation of the r.m.s. error m_h in the determination of the height differences between the extreme marks (e.g. m_h for the actuating tower = 2.8 mm; m_h for a silo building = 5.1 mm). Based on these requirements the maximum base $B_{max} = 2.5$ m and the distance between phototheodolite and installation $Y = 10$ m were calculated. (In Russian)

38. Stereofotogrammetrisk angiografi. By J. EDERYD and A. ÖSTMAN. Fotogrammetriska Meddelanden, 2(41): 45 pages (1978).

An investigation was carried out to determine the significance of the length and orientation of the base in stereophotogrammetric evaluation of X-rays from angiographs and to obtain an estimate of the accuracy obtained. A model representing blood vessels of a human brain was made of lead alloy and was photographed both with a Hasselblad MK 70 metric camera and on X-ray plates. (In Swedish)

59. Fotogrammetrische toepassingen: Scheepshoogtemetingen. (Photogrammetric applications: ship height measurements). By A.H. POLDERMANN. Geodesia, 18(10): 258-259 (1976).

A description of the height determination of ships with the aid of one or two cameras.

40. Využití metody světelných řezů ve speleologickém mapování. (Application of the light profile method in speleological mapping). By A. KALA. Geodetický a Kartografický Obzor, 22(5): 141-142 (1976).

Application of light profiles to photogrammetric surveys in spacious caves guarantees a quite sufficient accuracy for speleological mapping. The experience obtained with the mapping of caves in the CSSR and the methods applied are described; the accuracies obtained are discussed.

41. Analytické priestorové pretínanie napred v pozemnej fotogrammetrii. (Analytical spatial intersection in terrestrial photogrammetry). By J. CERNANSKY. Ibid., 22(10): 282-287 (1976).

The system of analytical spatial intersections proceeds from the known spatial co-ordinates of the camera stations, in the same way as with the classical method of geodetic intersection. To make the image parameters more precise, the taking camera and theodolite are centered relative to each other, the horizontal directions and elevation angles are measured geodetically according to the control points, the taking camera is oriented to the central control point and the levelling of taking cameras with level bubbles is used. The spatial co-ordinates of the detail points are determined on the basis of the corrected image co-ordinates by deriving the photogrammetric bearing angle and elevation angle.

42. Analytické určovanie priestorových zmien mosta SNP v Bratislave. (Analytical determination of deformations of a bridge in Bratislava). By J. CERNANSKY. Ibid., 23(4): 92-98 (1977).

Analytical restitution of terrestrial photograms, separate determination of the inner and outer orientation elements, determination of co-ordinates by means of spatial intersection. Accuracy analysis of the photogrammetric measuring results in relation to sags, displacements and deviations of the bridge during the load tests.

43. Blížká fotogrammetrie pri měření stavebních dílců. (Close range photogrammetry applied to the measurement of building components). By J. SMIDRKAL. Ibid., 23(5): 116-119 (1977).

Application of numerical close range photogrammetry with subsequent automatic data processing on the computer to establish the real dimensions and local unevennesses of the finished parts from which multi-story housing projects are assembled.

44. Spatial intersection in terrestrial photogrammetry by correcting the image co-ordinates. By V. GREGOR. Ibid., 23(9): 232-237 (1977).

Simple solution of the problem of spatial intersection in terrestrial photogrammetry by applying the original method of corrections of the image co-ordinates. Possibility of an application in engineering photogrammetry. (In Czech)

45. Determination of the depth of occurrence of an object to be analysed in roentgenology by a stereophotogrammetric method. By A.N. CERNY. Geodeziya i Aerofotos'emka, 20(2): 55-60 (1977).

A new method is described for the determination of the depth of occurrence of a roentgenographic object for medical purposes. A theoretical analysis is made of the accuracy and data of a practical examination are given. (In Russian)

46. Application of a test object for roentgenotopometric purposes in the normal case of stereoroentgenogrammetric survey. By A.N. CERNY. Ibid., 20(5): 88-95 (1977).

The present research is devoted to the use of stereophotogrammetric survey in medical roentgenology. A methodology is described for measuring the orthogonal co-ordinates of the points of an object with the aid of a special test object. (In Russian)

47. A special co-ordinate frame for a roentgenophotogrammetric magazine. By A.N. CERNY. Ibid., 20(6): 67-71 (1977).

A co-ordinate frame of a new construction is described by which the position of the principal point on the photograph can be recorded automatically. The theory of this device is explained and results of a practical application of stereophotogrammetry in roentgenology using such a co-ordinate frame are stated. (In Russian)

48. Application of the stereoroentgenogrammetric method to the determination of the outward form of an object. By A.N. CERNY, A.P. MIKHAILOV and E.M. PROCENKO. Ibid., 21(1): 64-67 (1978).

The possibilities are discussed of the stereoroentgenogrammetric method for the survey of the outward form of an object. The applied method of survey is described and the accuracy is investigated. (In Russian)

49. Measuring objects of a cylindrical and spherical form with the aid of X-ray photographs. By A.N. CERNY. Ibid., 21(2): 48-52 (1978).

The paper deals with the application of stereophotogrammetry in medical and industrial roentgenology. A theoretical argument is given for stereoroentgenogrammetric survey of cylindrical and spherical objects. A stereomodel of these objects is described and practical recommendations are given. (In Russian)

50. Application of a stereophotogrammetric method in an X-ray examination of objects with little marked relief. By A.N. CERNY, E.M. PROCENKO and L.A. MUZEUS. Ibid., 21(3): 72-80 (1978).
The article deals with the application of stereophotogrammetric survey to an X-ray examination of a pictorial art object. The theory of stereoroentgenogrammetric survey of objects with little marked relief is discussed and an original method of stereoroentgenography is described. The possibilities of the stereoroentgenogrammetric method are shown with a specific example.
51. Application of the moiré effect to the determination of the surface relief of an object. By A.N. CERNY and A.P. MICHAILOV. Ibid., 21(4): 57-61 (1978).
An original method of moiré X-ray topography is described. A theoretical argument is given on the possibility of using the moiré effect for the determination of the surface relief of an object with the aid of a photograph taken separately. The possibility of this method is demonstrated with a practical example.
52. Choosing a photo base value for compiling front plans of buildings by means of terrestrial photogrammetry. By V.K.L'VOV. Geodeziya i Kartografiya, 51(3): 57-69 (1976).
Formulae are given for computing the minimum photo base value for terrestrial stereophotogrammetric survey of the fronts of buildings and constructions. (In Russian)
53. Determination of the optimum base of phototheodolite survey for photogrammetric restitution of a stereopair on the Stereoautograph 1318. By E.M. FRANKIV. Ibid., 51(10): 51-53 (1976).
Two nomograms are proposed for choosing the optimum base in relation to the distance and r.m.s. error in the co-ordinates of the points to be determined. The nomograms are given for the phototheodolites Photo 19/1318 and UMK 10/1318. (In Russian)
54. Investigation into the geometric distortions of photographs obtained with a Scanning Electron Microscope. By V.N. FINKOVSKY and V.N. MELINIK. Ibid., 52(6): 38-44 (1977).
The geometric characteristics of image formation in a scanning electron microscope are discussed and their metric properties investigated. It is proposed to approximate the geometric distortion of SEM photographs by polynomials of the third power. It is recommended to use monodispersed polystyrene latex for the magnification determination of SEM photographs (with an accuracy of 5%). (In Russian)
55. Application of analytical photogrammetry in surveying various buildings. By V.M. SERDJUKOV and G.A. PATYCENKO. Ibid.: 52-58.
Main results of research and experimental work in carrying out architectural measurements and determining deformations of

buildings and models. (In Russian)

56. A device for automatic correction of the focal distance of a roentgenogrammetric camera. By A.N. CERNY, I.M. BONDAREV and E.M. PROCENKO. Ibid., 53(6): 52-54 (1978).

The authors discuss the theory and construction of a mechanism for automatic correction of the focal distance of a roentgenogrammetric camera designed for obtaining stereopairs of photographs by turning the object together with the magazine. (In Russian)

57. Full calibration of cameras with interchangeable inner orientation elements. By P.D. AMROMIN, T.S. ZIMINA and L.K. TRUBINA. Ibid., 53(8): 45-49 (1978).

A method is discussed for full calibration of cameras in close range survey, when the longitudinal spherical aberration in the entrance pupil of the lens is determined simultaneously with the radial distortion co-efficient. Results of experiments are stated.

58. Application of inter-perpendicular survey in roentgenology. By A.N. CERNY. Ibid.: 51-54.

Description of the theory of the inter-perpendicular case of stereophotogrammetric survey, stating results of the accuracy determination. The possibility is discussed of transforming a stereopair of the inter-perpendicular case into a stereopair of the normal type.

59. Photogrammetric restitution of photographs obtained on a scanning electron microscope. By V.J. FINKOVSKY and V.N. MEL'NIK. Ibid., 53(9): 46-52 (1978).

The authors discuss the theory of stereophotogrammetric restitution of photographs obtained on a scanning electron microscope. A method is proposed for the determination of the orientation elements of the photographs of a stereopair taken with a scanning electron microscope. The accuracy of stereoscopic height determinations from such photographs is analysed. A description is given of the technology of making test objects.

60. Badanie mozliwosci zastosowania aparatów fotograficznych do pomiarów precyzyjnych. (Application of non-metric cameras to precision measurements). By A. BUJAKIEWICZ. Geodezja i Kartografia, 27(1): 53-70 (1978).

The non-metric camera with tele-objectives ($f = 500$ mm, $f = 300$ mm, $f = 180$ mm) was applied to photogrammetric measurements of high precision. The analytical method for the determination of the parameters of small engineering constructions was used. The usefulness of tele-objectives was ascertained on the basis of experimental measurements.

61. Photo-documentation in the Forsmark tunnel, Uppland, Sweden. By A. CARLSSON, J. MARTNA and T. OLSSON. Geologiska Föreningens Förhandlingar, 100(1): 112-114 (1978).

In order to make the geological mapping of tunnels more comprehensible, it can be supplemented with stereo-photography by the method described here. This method is not new. However, it is applicable in the difficult environment of underground

excavations with a sufficient degree of accuracy for normal geological work.

62. Fassadenvermessung - Eine aktuelle Aufgabe der Ingenieurphotogrammetrie. (Facade survey - an actual task of engineering photogrammetry). By H. KAGER and P. WALDHAUSL. Geowissenschaftliche Mitteilungen, 8: 89-111 (1976).

The facades of two shell constructions, built by different methods, were measured photogrammetrically for the Vienna Institute of Building Research. Evidence was to be established on the accuracy of building achieved so far. At the same time, practicable computing programmes for the photogrammetry of facades were to be evolved.

63. Gemeinsame Ausgleichung photogrammetrischer, geodätischer und fiktiver Beobachtungen. (Simultaneous adjustment of photogrammetric, geodetic and fictitious observations). By H. KAGER and K. KRAUS. Ibid.: 113-133.

For the evidence of traffic accident scenes amateur photos are often referred to. Until recently amateur photos were analysed by means of graphic methods. In order to boost the efficiency of the procedure, a computer program is now being developed, permitting the simultaneous adjustment of photogrammetric, geodetic and fictitious observations.

64. Handbook of non-topographic photogrammetry. Edited by H.M. KARARA. American Society of Photogrammetry, 206 pages (1979).

The contents of this multi-author volume cover close range photogrammetry, terrestrial photogrammetry, underwater photogrammetry, X-ray and scanning electron microscope systems, holography and moire topography. It also incorporates an extensive bibliography.

65. Levelling inaccessible slope by terrestrial photography. By T.H. HALL. The Hong Kong Land Surveyor, 1(3): 4-15 (April 1979).

A detailed account is given of an experiment using horizontal convergent terrestrial photographs to supply spot levels on an inaccessible slope by an analytical method.

66. New horizons in medical measurement. By A.R. WILLIAMS. Industrial and Commercial Photographer, 17(11): 60-69 (November 1977).

The author describes the techniques of stereophotogrammetry and light sectioning as two examples from the range of methods which use photography as an accurate measuring tool and which show that the camera can be an invaluable aid to the surgeon, physician and medical researcher.

67. Nahbildphotogrammetrie und Ingenieurvermessung. Themenkreis 1: Vermessungsmethoden und-instrumente. (Close range photogrammetry and engineering surveying. Group of subjects 1: Surveying methods and instruments.) By S. HEGGLI. Vllth International Course for High Precision Engineering Surveys, Darmstadt Technological University. 1: 103-113 (1977).

Photogrammetry is represented as a measuring method, especially with regard to close range measurements in engineering surveying. A general review is given on that subject. First,

special problems of close range photogrammetry are dealt with: focusing, calibration, survey arrangement, geodetic reference data, attainable accuracies. Furthermore, measuring methods (monophotogrammetric method; stereophotogrammetric methods; space-time method) are dealt with and application examples are listed.

68. Photogrammetrische Vermessung (Deformationsmessung) von statisch und dynamisch belasteten Schwimmbrücken. Themenkreis 3: Bauwerksüberwachung und Beweissicherung, (Photogrammetric survey (deformation measurement) of statically and dynamically loaded floating bridges. Group of subjects 3: Building control and documentation.) By F. LÖSCHER and G. KAHLER. Ibid.: 513-523.
The problem of documentation survey of moving objects under dynamical loads is solved photogrammetrically with the example of deformation measurement of floating bridges. Two aerial survey cameras adapted to horizontal photographs with an exposure interval of 2 s can, in case of need, be tripped intermittently or synchronously. Then, by means of single photograph measurement, the course of submerging lines together with load position and also the longitudinal shifting of a floating bridge of 150 m length can be determined every second. Besides, by means of stereoscopic measurements, the lateral movement of the bridge can be recorded at an interval of 2 s. Further parameters such as vessel speed and submerging speed can be determined by both methods.
69. Calculation of the lengths of the bases in the case of regularly averted phototheodolite survey of large open-cuts. By K.E. BURAK. Inzenernaja Geodezija, 19: 17-24 (1976).
Formulae are analysed by which the minimum value for the length of the base can be found, which guarantees the specified accuracy of determination of the spatial co-ordinates within the range of the whole useful area of the stereopair. A nomographic solution of the recommended formulae is given for compound nomograms from adjusted points. (In Russian)
70. Einige Probleme der Photogrammetrie in Antarktika. (Some problems of photogrammetry in Antarctica). By K. DRESZLER. Jena Review, 21(2): 88-92 (1976).
The characteristic topography of Antarctica makes the application of terrestrial photogrammetry more complicated. Experience with the 19/1318 phototheodolite and the Steko 1818 stereocomparator of VEB Carl Zeiss JENA and some considerations concerning an aerophotogrammetric surveying method.
71. Ein Beispiel für die Anwendung der Photogrammetrie bei Deformationsmessungen. (An example for the application of photogrammetry to deformation measurements). By V. KAKSONEN. Ibid.: 107-109.
Describes use of the UMK 10/1318 universal photogrammetric camera of VEB Carl Zeiss JENA for the determination of deformation values.
72. Der Topocart als Auswertegerät in der Architektur-Photogrammetrie. (The Topocart as a restitution instrument in architectural photogrammetry). By R. MEYER. Ibid.: 114-116.

Proceeding from the special problems of architectural photogrammetry, some aspects of the survey arrangements are explained. A comparison of the parameters of the known surveying apparatus with those of the Topocart shows that this instrument meets all requirements. The conception of the Topocart permits the application of variable survey arrangements, furthers the economy of the work and allows the recording of objects even under unfavourable local conditions. It appears from the comparison between Topocart and Technocart that for special operations a Topocart with the optics of the Technocart is very suitable. The altered instrument proves good in practice.

73. Erfahrungen beim Einsatz der Photogrammetrie in der schiffbaulichen Fertigung. (Experience with the application of photogrammetry in ship-building). By W. BEGLER, G.H. HERZ and R. SCHROTER. Ibid., 23(2): 57-60 (1978).

Application of terrestrial stereophotogrammetry to the survey of ship sections in order to determine the accuracy of the preliminary assembly and to record the effects of transport. Numerical restitution according to stereometer data with automatic mapping. The discussion of the results proves that photogrammetry is suitable for checking production methods, especially for the spatial survey of complicated structures.

74. Photogrammetry of spherical shocks reflected from real and ideal surfaces. By J.M. DEWEY, D.J. McMILLIN and D.F. CLASSEN. Journal of Fluid Mechanics, 81(5): 701-717 (August 1977).

A photogrammetric technique has been used to study the interaction of two identical explosively produced spherical shock waves and to compare this interaction with the reflection of one of the spherical shocks from the ground.

75. An application of color photo-montage and color photo-simulation to civil engineering design. By S. OHBAYASHI. Journal of the Japan Society of Photogrammetry, 16(2): 1-9 (1977).

The design of large civil engineering structures should take into account the visual harmony of the structures with their environment as well as economic and safety factors. The author gives examples of a colour photo-montage technique which can be used to evaluate the effect of various changes in design. (In Japanese)

76. Operational utilization of stereo-camera system in national Police Agency. By A. ASAKAWA. Ibid., 17(1): 18-23 (1977).

A stereometric camera system was first introduced into the traffic division of the National Police Agency in Japan in 1967. By the end of 1971, every prefectural police area had adopted it and today 256 vans carrying stereometric equipment and 76 stereoplotting instruments are in operation all over the country. They have made a great contribution to the scientific examination of traffic accidents resulting in injury or death. (In Japanese)

77. Practical use of photogrammetry in Kanagawa Prefectural Police. By M. UOTANI, M. YAMAGUCHI, Y. GOTOH, T. MIYASAKA and K. YANO. Ibid.: 24-32.

Detailed descriptions are given of the use of stereometric

- cameras (1.2 m base) in recording the scenes of traffic accidents. The article is illustrated with stereopairs and road plans and sections. Other applications of the use of stereometric cameras, such as defining the buckled shape of a crashed car and also contouring a human face, are subsequently considered. (In Japanese)
78. A study on the properties of an under-water photograph taken by terrestrial camera. By R. IZAWA and Y. SUZUKI. Ibid., 17(3): 4-14 (1978).
The authors investigated the distortions caused by refraction on an under-water photograph taken with a camera whose lens system was manufactured for aerial use. Optical distortions are also caused by the shape of the front window of the waterproof receptacle containing the camera. (In Japanese)
79. Aerial photogrammetry by the radio controlled midget aircraft named "Hang-plane". Ibid., 17(4): 4-12 (1978).
A radio controlled model aeroplane may be used for aerial photography, but has some problems with regard to stability and safety. The authors have constructed a new aeroplane with a flexible wing. An aerial photogrammetric experiment has been carried out using a Hasselblad Mk 70 camera mounted in this "Hang-plane". (In Japanese)
80. An experiment and a consideration about moire patterns contrast. (1.) By M. KUREYA. Ibid.: 13-20.
The author describes the use of a moiré pattern technique to obtain the contours of a female dummy. (In Japanese)
81. Stereo-videography of micro-dissection and its observation. By M. YAMADA and K. KUMAKI. Ibid., 18(1): 4-11 (1979).
Twin light weight television cameras have been mounted on a stereomicroscope and the stereoscopic image recorded on one videotape. Since the screen has to be observed with crossed or convergent eye axes preferably by a number of observers at a time, special prism viewing glasses have been developed. The author also discusses the purposes and effects of this method and possible improvements in the instrument design. (In Japanese)
82. Photogrammetry's use in fixing scenes. By P.E. BORCHERS. Landscape Architecture, 66(3): 270-275 (1976).
Photogrammetry may be simply defined as the science of measuring by means of photography. Recent research in the American southwest has demonstrated the applicability of the technique to landscape architecture as well as architecture as a means of recording historical landscapes. Of particular value, the technique can be used to reconstruct such landscapes from scanty documentary evidence which can be accurately related, at low cost, to the present scene.
83. A portable stereometric camera for clinical measurement. By L.F.H. BEARD and P.F. DALE. Medical and Biological Illustration, 26(2): 107-110 (1976).
By using a hand held stereometric camera with a datum frame having collimation marks, a rapid method for carrying out analytical photogrammetry has been developed. The method requires

no additional sophisticated equipment and measurements of the three dimensional co-ordinates of selected points can be derived by a person unfamiliar with photogrammetry.

84. Aus der Praxis der Architekturphotogrammetrie. (From the practice of architectural photogrammetry). By D. EBENFELD, Mitteilungen DVW Hessen, 29(2): 2-13 (1978).

During the past two to three years, many buildings have been surveyed photogrammetrically and mapped in elevation at a large scale in Frankfurt am Main. From the point of view of monument preservers and photogrammetrists, this is a promising beginning to an extensive inventory of historically valuable buildings. The manifold tasks and experiences which could be gathered are reported with regard to mono- or stereophotogrammetry, technical equipment, photography and restitution, cost and questions of accuracy.

85. Dreidimensionale Auswertung von nach Blödorn und Lange aufgenommenen elektronenmikroskopischen Stereobildern. (Three-dimensional restitution of electron-microscopic stereographs taken according to Blödorn and Lange). By R. BURKHARDT. Optik, 50(4): 279-296 (1978).

According to the method of Blödorn and Lange, electronmicroscopic stereographs are obtained by means of object rotation in an inclined plane. Advantages for stereoscopy and stereoscopic measuring are explained. The geometric relations between image and object co-ordinates are derived and orientation and measuring methods on the stereocomparator are indicated. The object system chosen is such that when checking by means of repeated surveys it would be possible to calculate in the same co-ordinate system. The programming on a pocket computer is described and an example is given. Profile measuring is also explained. A stereograph illustrates the three dimensional effect.

86. Der Erdbebeneinsatz der Photogrammetrischen Abteilung des Bundesdenkmalamtes in Friaul. (The earthquake mission of the photogrammetric department of the Federal Office for monument preservation at Friaul). By H. FORAMITTI. Österreichische Zeitschrift für Vermessungswesen und Photogrammetrie, 65(1): 17-19 (1977).

In the crisis area of the Friaul-Venice-Giulia region, cathedrals were recorded photogrammetrically and castle and court facades of old city streets were surveyed. The use of photogrammetric cameras (SMK 120 of Zeiss and others) is described as well as the most important experiences of the measuring campaign lasting two weeks. Finally, conclusions are drawn for other emergency cases.

87. Displacement and deformation measurements over longer periods of time. By E. DAUPHIN and K. TORLEGÅRD. Photogrammetria, 33(6): 225-239 (December 1977).

A time parallax measurement procedure was used to determine displacements over periods of time in two investigations. Firstly, the magnitudes of displacements in a vertical plane occurring in the walls and roof of an underground mine in central Sweden were required. The area to be studied was photographed stereoscopically using a Wild P32 phototheodolite mounted on an

elevator tripod. At a later date, only single photographs were taken, with the camera in as nearly the same position and directed in as nearly the same orientation as possible as for one of the earlier stereophotographs. After applying corrections for possible variations in inner orientation, and performing an absolute orientation on geodetically determined reference points, the displacements of all the measured points were determined. Secondly, a simulated investigation was carried out to determine the practicability and accuracy of determining the relative displacements of adjoining building elements in multistorey structures. In this case, only single photographs were taken with a Hasselblad super wide angle, non-metric, film camera. This investigation was conducted indoors under relatively favourable conditions.

88. Stereoscopic vision - a problem in terrestrial photogrammetry. By J. DALSGAARD. Ibid., 34(1): 3-18 (January 1978).

In many terrestrial photogrammetric applications, such as geomorphology, it may be difficult to find the correct relationship between base and object distance to secure the stereoscopic effect. The conventional limits do not guarantee a satisfactory stereoscopic model owing to the eye's power of accommodation, calling for compensation through the choice of base ratio. The length of the photo base is found to be a function of the slope towards the photo base in addition to the object distance and the calibrated focal length. The importance to stereoscopic vision of the anatomy of the eyes is also demonstrated.

89. The estimation of fractures and slope stability of rock faces using analytical photogrammetry. By M.W. ALLAM. Ibid., 34(3): 89-99 (May 1978).

A technique for use in open pit mines was developed using analytical photogrammetric methods to determine the width, position and orientation of fractures in rock faces and also to determine the orientations of structural features such as joint sets, cleavage planes and fault surfaces to effectively control the maximum slope angle that can safely be excavated. Photography was obtained using a Wild P30 phototheodolite and photogrammetric mensuration was performed on a Wild STK 1 stereocomparator.

90. Tank calibration by stereophotogrammetry. By H. PAPO and B. SHMUTTER. Ibid.: 101-109.

Calibration of a cylindrical storage tank was performed by wide angle photography and simultaneous adjustment of wall point co-ordinates and camera station parameters. The tank was photographed from the inside from 11 concentric positions of the camera set on the tank bottom. Photography was carried out using a Zeiss (Oberkochen) TMK camera by leaving the shutter open at each station and sweeping the field of view with a flash light at a precalculated speed.

91. A review of close-range engineering photogrammetry. By K.B. ATKINSON. Photogrammetric Engineering and Remote Sensing, 42(1): 57-69 (January 1976).

An attempt has been made to review recently published examples of close-range engineering photogrammetry. Many of

these describe work in the United Kingdom. They include the recording and measurement of dam displacements, unstable geological structures, snow cover, soil, structural and hydraulic models, constructional problems and box girder load tests.

92. State-of-the art of close-range photogrammetry. By A.K.I. TORLEGÅRD. Ibid.: 71-79.

The article reviews cameras and photography, measuring instruments and methods for applications of close range photogrammetry.
93. Analytical on-line systems in close-range photogrammetry. By V. KRATKY. Ibid.: 81-90.

The potential uses of the analytical plotter in close range photogrammetry are explored and generalised analytical concepts are presented.
94. Comparison of optical contouring methods. By N. BALASUBRAMANIAN. Ibid.: 115-120.

In the last few years several direct optical contouring schemes have been proposed and demonstrated. An effort is made in this paper to identify some of their characteristics and evaluate their performance as it relates to their application in close-range photogrammetry. It is shown that, even though these systems exhibit potential and promise, further development in technique is necessary before they can become competitive to stereophotogrammetric systems.
95. Recent development of industrial photogrammetry in Japan. By T. OSHIMA. Ibid., 42(3): 339-342 (March 1976).

Close-range photogrammetry has been applied to the dynamic measurement of rotating tyres, the determination of the subsidence of launching ways, the investigation of marine propeller cavitation and the measurement of architectural models.
96. Canadian contribution to hologrammetry. By J.P. AGNARD. Ibid.: 343-344.

A review is made of the research undertaken since 1969 in hologrammetry. Discussion on the directions hologrammetric research will take is emphasised and mention is made of current and intended investigations, i.e., automatic contour generation with conventional stereomodels by means of laser techniques.
97. Accuracy of close-range analytical restitutions: practical experiments and prediction. By P. HOTTIER. Ibid.: 345-375.

The distinction between precision and accuracy, the prediction of accuracy and the effects of redundant measurements, geometry and the use of non-metric cameras are discussed.
98. Orthophotography in architectural photogrammetry. By E. SEEGER. Ibid., 42(5): 625-635 (May 1976).

Orthophotography preserves more detail and can be prepared more rapidly than conventional stereoplotted line drawings. The examples of orthophotographs given in this report show a variety of possible applications and demonstrate the qualifications of different orthophotoprojection systems for architectural tasks.
99. A non-metric close-range photogrammetric system for mapping

geologic structures in mines. By V.D. BRANDOW, H.M.KARARA, H.H. DAMBERGER and H.F. KRAUSSE. Ibid.: 637-648.

Close range photogrammetry was used in conjunction with conventional geologic field studies to collect structural data in mines as an integral part of a search for geological indicators of mine roof instability. The four tests described in this paper show that an analytical photogrammetric system utilising a small format non-metric camera meets the accuracy requirements of geological work and that the method is not only technically feasible but also a practical procedure.

100. Scanning electron micrography and photogrammetry. By S.K. GHOSH and H. NAGARAJA. Ibid.: 649-657.

With the growing need for serious quantitative investigations with scanning electron microscope (SEM) micrographs, more attention is being drawn to statistically sound metric calibration of the SEM system and to a general understanding of the inherent distortions in the SEM micrographs. By using the collinearity condition with respect to perspective and parallel projections and an advanced photogrammetric self-calibration technique, one obtains the patterns of scale, radial, tangential and spiral distortions. These are discussed and the corresponding mathematical models are presented.

101. Photogrammetric measurement of the human optic cup. By G.D. CURRIE, C.D. LEONARD and C.L. MARTONYI. Ibid., 42(6): 807-813 (June 1976).

Precise measurement of the volume of the human optic cup has been proposed by several medical researchers as a method of diagnosing and monitoring the progress of glaucoma in humans. When photogrammetry is used, it is very difficult for the photogrammetrist to determine the location of the surface of the optic cup. An improved method of projecting patterns on to the optic cup so that the cup surface is easier to define is described. The projected pattern is also especially useful in determining the volume of the cup by the method of optical sectioning.

102. Mapping street intersections using close-range photogrammetry. By J. KOBELIN. Ibid., 42(8): 1083-1089 (August 1976).

A joint project using close range photogrammetry to map street intersections has been conducted by the Dade County Traffic and Signalisation Department and the Civil Engineering Department of the Miami-Dade Community College. Using part time students employed by the traffic department, a procedure was developed which is operationally effective and the resulting maps plotted by the students have met all the traffic and transportation department accuracy standards.

103. Photogrammetric self-calibration of scanning electron microscopes. By D.F. MAUNE. Ibid., 42(9): 1161-1172 (September 1976).

Photogrammetric self calibration can be used to mathematically model systematic scanning electron microscope distortions. Spiral distortion, resulting from non-linear electron scanning, is particularly significant.

104. Fixed-frame multiple-camera system for close-range photogrammetry. By S.A. VERESS and R.S. TIWARI. Ibid.: 1195-1210.

The fixed frame multiple camera system described consists of a geometrical arrangement of three MK-70 metric Hasselblad cameras. The framework provides a reference system and is constructed from triangular shaped steel tubes pressed into a solid joint. It has been found that this system is capable of providing fast and accurate three dimensional measurement, particularly applied to the field of orthopaedics.

105. The analytical plotter in close-range applications. By S.E. MASRY and W. FAIG. Ibid., 43(1): 89-94 (January 1977).

The flexibility of the analytical plotter allows the use of different procedures to improve the accuracy and overcome most of the problems of close range applications such as handling of incomplete stereo-models, plotting projections on to different planes and distortion corrections. This paper summarises some of the procedures and software developed for the analytical plotter with emphasis on architectural applications.

106. A photogrammetric technique for use in radiation therapy. By W.D. RENNER. Ibid., 43(5): 581-591 (May 1977).

A photogrammetric technique was developed for determining the topography of that portion of a patient's surface undergoing radiation therapy. Simplification was achieved by utilising the source light of the radiotherapy unit to project one of a stereopair of photographs. Spatial accuracy of the order of 3 mm was easily achieved by using a polaroid camera and an opaque projector. An application of the technique to designing lead sheet tissue compensators is presented.

107. Applications of photogrammetry in shipbuilding. By J.F. KENNEDY. Ibid., 43(9): 1169-1175 (September 1977).

In conjunction with the National Shipbuilding Research Program, the potential for applying photogrammetry within the US shipbuilding industry has been assessed. Several applications of photogrammetry were undertaken for demonstration purposes. These included the measurement of a midship section, the development of piping drawings from a design model, the survey of a section of a large cylinder and a check on the shape of a ship's cross section bounded by highly curved shell plating.

108. An analytical approach to X-ray photography. By S.A. VERESS, F.G. LIPPERT and T. TAKAMOTO. Ibid., 43(12): 1503-1510 (December 1977).

A calibration, employing collinearity equations, and a laboratory process provided an accuracy of ± 0.04 mm in distance and $\pm 0.09^\circ$ in rotation.

109. Photogrammetric monitoring of a gabion wall. By S.A. VERESS and L.L. SUN. Ibid., 44(2): 205-211 (February 1978).

A gabion wall, which is being built as part of the Interstate Highway 90 east of Seattle, is being monitored by a terrestrial photogrammetric method using a modified KA-2 camera. The design of the geometry of the camera stations and their measurements are discussed. The method by which the photogrammetric monitoring was performed is described and its accuracy is presented. A typical deformation of a target in the horizontal direction is shown.

110. A plotting instrument for close-range photogrammetry. By S.A. VERESS and J.N. HATZOPOULOS. Ibid., 44(3): 273-283 (March 1978).
The design, calibration and operation of a stereoplotter employing Balplex projectors and suitable for close range stereoscopic and mirror photography is described.
111. An approximate solution for the restitution of stereo electron micrographs. By P. WALDHÄUSL. Ibid., 44(8): 1005-1009 (August 1978).
The mathematical basis and procedures for restituting stereoscopic electron micrographs in photogrammetric analogue plotters such as the Zeiss (Jena) Topocart are described.
112. An orientation and calibration method for non-topographic applications. By H. BOPP and H. KRAUSS. Ibid., 44(9): 1191-1196 (September 1978).
From the basic relations of a linear transformation, an exact solution for the orientation and calibration of cameras is derived. This solution leads to a least squares adjustment with linear fractional observation equations and non-linear additional constraints. The transformation parameters are computed iteratively using three dimensional object space control. With these parameters, the object space co-ordinates of all image points, contained in at least two photographs, can be determined in a second step. The efficiency of the method is demonstrated with data of some control surveys of wide spanning surface structures.
113. Photogrammetric positioning of supersonic wind tunnel models. By U. ETHROG. Ibid., 44(10): 1261-1265 (October 1978).
The confined space in a supersonic wind tunnel laboratory and the very short duration of the free flight tests cause serious difficulties in measuring the position of the models inside the tunnel during the test. In order to overcome these problems, a simple system was arranged for use with high speed photography and an appropriate procedure for photogrammetric data reduction was developed. The position and orientation of the model are determined to an accuracy of a few millimetres, which exceeds the requirements for such tests.
114. Stereo measurement of the optic disc. By T. TAKAMOTO, B. SCHWARTZ and G. MARZAN. Ibid., 45(1): 79-85 (January 1979).
Glaucoma can be detected in its early stages by studying changes in the optic disc. The basic elements in retinal stereoscopic photogrammetry were analysed on human optic nerves and the reproducibility of relative measurements was estimated. The Donaldson Retinal Camera was used with an aperture size of 4.0 mm and a magnification of X 3.
115. Stereometric measurement of streambank erosion. By S.H. COLLINS and G.C. MOON. Ibid., 45(2): 183-190 (February 1979).
In a study of the amounts and sources of the silt that enters the lower Great Lakes, measurements of the banks of streams and ditches were made from stereometric photographs taken over a period of three years. This paper discussed the siting of the Zeiss (Oberkochen) SMK 120 stereometric camera,

the recovery of the camera position from one session to the next, the photographic techniques employed, the methods of stereometric measurement, the computer program for volume determination and the accuracy of the work.

116. The application of photogrammetric techniques to building construction. By Y.I. ABDEL-AZIZ. Ibid., 45(4): 539-544.

The problem of locating the three dimensional positions of the inserts used in the construction of precast slab buildings has been solved by using surveying procedures to acquire the measurements and photogrammetric techniques to reduce the data.

117. Atmospheric refraction compensation in terrestrial photogrammetry. By C.S. FRASER. Ibid., 45(9): 1281-1288.

The adoption of long focal length cameras in precise photogrammetric deformation surveys incorporating photographic distances of about 1 km has recently been reported. Over such ranges, optical wave path curvature due to atmospheric refraction can give rise to image displacements of up to 10 μ m when a 610 mm focal length camera is employed in normal meteorological conditions. A simulation is described which supports the contention that, over photographic distances of several hundred metres, the influence of vertical refraction on the imaging process can be significant.

118. Experiences of vertical profiling of buildings with photogrammetric means. By J. JAAKKOLA. The Photogrammetric Journal of Finland, 7(2): 135-140 (1978).

In order to facilitate the joining of a new building to an old one in the centre of Helsinki, it was decided to measure vertical profiles for the walls of the old building. The photography was performed with a Zeiss (Oberkochen) TMK camera from the windows of a building on the opposite side of the street. Measurement of the photographs was carried out on a Wild A8 plotting machine.

119. The service for architectural photogrammetry in Poland: organisation and experience. By W.A. KOLATAJ. Photogrammetric Record, 8(47): 583-588 (April 1976).

A description of architectural applications of photogrammetry in Poland.

120. The measurement of palatal surface area by photogrammetry. By I. NEWTON and M.S. EVANS. Ibid., 8(47): 646-651 (April 1976).

An application of photogrammetry in the measurement of palatal surface area is described. The accuracy of the photogrammetric method in such applications is also discussed.

121. Underwater photogrammetry. By E.J. MOORE. Ibid., 8(48): 748-763 (October 1976).

Microrelief mapping of the sea bed can only be carried out by photo-optical methods. It is shown that suitable equipment, bought off the shelf, can produce useful results. The paper describes equipment performance trials and a practical application in a study of large scale sea bed topography.

122. Determining the kinematics of falling hailstones using photogrammetric methods with imprecisely aligned cameras. By A.G. BEATTIE and E.P. LOZOWSKI. Ibid., 8(48): 781-793 (October 1976).

Stereophotography with a pair of 35 mm cameras and stroboscopic illumination was used to record, reconstruct and measure the trajectories of falling hailstones under extremely adverse natural conditions. Since it was not possible either to fix or to measure precisely the camera positions and orientations, a method was devised to obtain both the three dimensional hailstone co-ordinates and the camera positions and orientations by making use of the otherwise redundant information contained in the stereophotography.

123. Close range camera calibration: a new method. By P.J. SCOTT. Ibid., 8(48): 806-812 (October 1976).

A camera calibration method for object distances of 1 m to 4 m is described.

124. The shapes of small pebbles. By B. CHIAT. Ibid., 9(49): 71-82 (April 1977).

A stereoscopic pair of photographs, with a common ground principal point and a scale of approximately 1 : 1, is produced by mounting specimens (grains of sand or similar material) on a microscope stage which is capable of being tilted to a selected angle under a camera fixed in a vertical attitude. The production of contour plans at an enlarged scale in a stereoplotter and from paper prints using simple apparatus is discussed.

125. The pupil in perspective. By P.J. SCOTT. Ibid., 9(49): 83-92 (April 1977).

When exit pupil and rear node do not coincide in a camera lens, the inner perspective centre is shown to depart from the rear node at close focal settings. Ignorance of the departure is demonstrated to be responsible for the variation of principal distance with object distance which is believed to exist by some photogrammetrists. Subsequently, variation of entrance pupil with incident angle is shown to produce a small change in principal distance of a different form. Theory is substantiated by experimental results.

126. Photogrammetry for cooling tower shape surveys. By N.W.T. CHISHOLM. Ibid., 9(50): 173-191 (October 1977).

Quantitative assessment of the imperfections in the shape of cooling towers is required to enable strength studies to be carried out. Terrestrial photogrammetric methods are described which provide the initial data by locating the position of surface cracks and depicting the surface by means of ring contours. These serve as a basis for further analysis.

127. The experimental recording of petroglyphs and archaeological sites. By D.A. SCOGINGS. Ibid., 9(51): 327-341 (April 1978).

A short review is given of photogrammetric methods in use for the test recording of petroglyphs and archaeological sites. Two simple field methods employed by archaeologists to record petroglyphs are also described in order to highlight the

complexity of photogrammetric techniques and to query their validity.

128. Structural deformation measurement of a model box girder bridge. By P.J. SCOTT. Ibid., 9(51): 361-376 (April 1978).

A model of a multiple box girder bridge, constructed at a scale of 1 : 12, was subjected to an ultimate load test. Deformations were measured photogrammetrically using the method of false parallax. Modifications to the method are described which were necessary to accommodate the three dimensional object and to allow for the fact that the camera stations were not constant from one load stage photograph to the next. An accuracy of ± 0.2 mm in the measured deformations was achieved.

129. The use of a non-metric camera for very short range dental stereophotogrammetry. By L.P. ADAMS. Ibid., 9(51): 405-414 (April 1978).

This paper describes the modification, calibration and testing of a non-metric Linhof Technika View camera for use in the stereophotogrammetric mapping and analysis of dental features. The importance of correcting for errors of convergence in very short range stereophotogrammetry is stressed.

130. Educational and research aspects of non-metric, close range analogue photogrammetry. By R.WELCH and K.DIKKERS. Ibid., 9(52): 537-547 (October 1978).

A close range photogrammetric system, developed around a 35 mm Pentax camera fitted with a wide angle lens ($f = 21\text{mm}$) and an early Zeiss wide angle multiplex, has proved useful for both instruction and research. Student exercises involve all phases of photogrammetry, from establishing ground control to plotting, and permit the integration of useful statistical routines for data analysis. Research applications have centered on the topographic mapping of microscale land forms at scales of 1 : 1 to 1 : 10 with accuracies of ± 1 mm to ± 5 mm.

131. Analytical photogrammetry in engineering: three feasibility studies. By M.A.R. COOPER. Ibid., 9(53): 601-619 (April 1979).

Three investigations of the suitability of photogrammetry as a method of measurement are described, in the fields of marine, mechanical and structural engineering. Analytical solutions for a single model, a strip and a block of photographs are discussed.

132. The application of photogrammetry to current determination in an hydraulic model. By B. CHIAT, J. GURR and S.J. ROBINSON. Ibid., 9(53): 659-667 (April 1979).

Water currents in an hydraulic model have been determined by means of a photogrammetric method of detecting the movement of tethered buoys. Single vertical photographs, taken by a non-metric camera, have been analysed to produce the required differential measurements. The use of a non-metric camera is justified by an analysis of the errors involved and a consideration of the requisite type of measurements.

133. Relative orientation problems. By S.I. GRANSHAW. Ibid.,

9(53): 669-675 (April 1979).

Problems are sometimes encountered during the relative orientation of close range photography which has a limited usable format and a large Z range. Computer simulations and practical tests with both a comparator and a plotting instrument are used to investigate the problems and possible inaccuracies. Systematic errors in the photogrammetric model are revealed.

134. X-ray photogrammetry of gas turbine engines at Rolls-Royce. By P.A.E. STEWART. Ibid., 9(54): 813-821 (October 1979).

The author describes the use of a radiographic electron linear accelerator to record internal changes of component configuration within gas turbines. The technique does not require any special engine modification. A real time X-ray television system has been devised to provide continuous monitoring of events within the engine. The examination of air seals by high energy X-rays is presented as an example of the use of the two dimensional technique. A three dimensional method using a stereoscopic pair of radiographs is now being developed.

135. Three dimensional reconstruction in anatomy using photogrammetry. By P.N. GAUNT. Ibid., 9(54): 823-834 (October 1979).

The author reviews procedures for obtaining stereomicrographs from binocular and monocular optical microscopes, from transmission and scanning electron microscopes and from an X-ray microscope. A description is given of the EMPD2 plotter for stereomicrographs and the advantages of various reconstruction techniques are considered, including a computer method used in the study of virus particles.

136. An experiment with analytical shadow stereophotogrammetry. By L.P. ADAMS. Ibid., 9(54): 835-847 (October 1979).

This paper describes the production of stereopairs of shadow photographs to simulate X-ray pictures and demonstrates the possibility of determining analytically the precise position in the object space of foreign bodies using a digitiser as a monocomparator and projective transformation theory to dispense with the necessity of undertaking normal inner and relative orientation analytical procedures. A model is constructed and comparison accuracy tests are made using shadow and X-ray picture pairs. The paper also suggests that the use of projective transformation theory is more appropriate in short range photogrammetry than traditional topographic stereo-photogrammetric theory.

137. Camera calibration at very close focal settings. By P.J. SCOTT and A. GEORGOPOULOS. Ibid., 9(54): 853-855 (October 1979).

A simple method is described for calibrating cameras at object distances of less than 0.5 m.

138. Photography in non-topographic photogrammetry. By K.B. ATKINSON. Photographic techniques in scientific research, 3: 271-313 (1978).

A comprehensive review of photographic materials and cameras used in non-topographic photogrammetry is followed by the description of a carefully selected set of applications in architecture, engineering and biomedicine.

139. On-line analytics for close-range photogrammetry. By V.KRATKY. Proceedings of the American Society of Photogrammetry, Fall Convention, Seattle, Washington: 58-73 (1976).

Analytical on-line systems are shown to be well suited for close-range photogrammetry. The basics of this type of photogrammetric processing are reviewed and a general formulation presented which allows for most universal applications. A suitable computer program developed for the on-line solutions in close-range photogrammetry is described and its versatile functions illustrated in several practical examples.

140. Photogrammetric monitoring of structural displacement. By J.C. PETERSON. Ibid.: 74-86.

Since 1973, the Seattle District, Corps of Engineers has conducted a study of the use of photogrammetric instruments to detect structural displacement. The method should be of interest to geologists, engineers, photogrammetrists, or anyone else who is charged with detecting the displacement of structures such as bridges, buildings or slide areas. This paper examines the results from three projects which have been monitored: an apartment building near the Lake Washington Ship Canal in Seattle, Washington: a landslide area near an earthfill dam in Washington and an ancient slide area near Chief Joseph Dam in Bridgeport, Washington. The paper includes a brief description of the photogrammetric system and concludes with a discussion of the computer program used to reduce the data. Although the technique used is relatively new and is still under development, it produced favourable results in all three cases.

141. Determination of patella tracking patterns by X-ray photogrammetry. By F.G. LIPPERT and T. TAKAMOTO. Ibid.: 107-121. The patella is frequently the source of pain and disabling arthritis because of abnormal tracking patterns which result in uneven wear between the contacting surface. In order to evaluate various treatment methods which are supposed to correct the faulty dynamics, the authors have devised a measurement technique using X-ray photogrammetry. Stainless steel markers are implanted surgically in the patella and femoral condyles. The three dimensional motion of the patella relative to the femoral condyles is determined photogrammetrically. This method is sufficiently accurate and its resolution good enough to make it a highly useful clinical tool.

142. Mapping of stump using close range photogrammetry. By S.A. VERESS, R.S. TIWARI and J.N. HATZOPOULOS. Ibid.: 122-138.

The problem of mapping below the knee amputated human stump has been discussed along with the various approaches to solve it. Details of an instrument which has been fabricated for the conventional photogrammetric mapping are given along with its applications. The results of the various approaches have also been given.

143. Solids mixing and segregation in spouted beds. By G.S. McNAB and J. BRIDGWATER. Proceedings of Third European Conference on Mixing, York, 1979, Paper B1: 125-140.

The photogrammetric evaluation of cine photography provides a method for studying particle flows in the spout, fountain,

free surface region and annulus of a half-cylindrical spouted bed.

144. Underwater photogrammetry. By E.J. MOORE. Progress in underwater science. Volume 3. Proceedings 11th symposium of the Underwater Association, London. Ed. J.C. Gamble and R.A. Yorke. Pentech Press. Pages 101-110 (1978).
This report describes the development and application of a simple, easily constructed photogrammetric system for use under water. Equipment performance trials are described followed by a practical application in a detailed study of sea bed micro-relief.
145. Fotogrametryczna rekonstrukcja Wieży Władysławskiej Zamku Królewskiego w Warszawie. (Photogrammetric reconstruction of the Władysław tower of the Royal Castle in Warsaw). By Z. PODGORSKI. Przegląd Geodezyjny, 48(5): 179-180 (May 1976).
Development and results of the reconstruction of this destroyed building based on two photographs taken in 1915 and 1924.
146. Możliwości zastosowania autografu Wilda A-6 do opracowania inwentaryzacji architektonicznej obiektów zabytkowych. By M. GRALIŃSKI. Ibid., 48(9): 396-400 (September 1976).
The author examines the possibility of using a Wild A6 for the compilation of an inventory of historic monuments of architectural interest. (In Polish)
147. Zastosowanie Topokartu do tworzenia rysunków perspektywicznych. By R. TOKARCZYK and A. TOKARCZYK. Ibid., 48(12): 498-500 (December 1976).
The authors describe how perspective drawings and an architectural elevation may be obtained with the aid of a Zeiss (Jena) Topocart. (In Polish)
148. Fotogrametryczna dokumentacja stanu baszty w Odrzykoniu po awarii. By A. MAJDE, M. NIEPOKÓLCZYCKI and H. SKROBEK. Ibid., 49(5): 178-180 (May 1977).
Terrestrial photogrammetry was used to establish the constructional state of the damaged belfry of Odrzykoń. (In Polish)
149. Fotogrametryczna metoda sporządzania dokumentacji pomiarowej odkształceń słupów żelbetowych. By M. NIEPOKÓLCZYCKI and H. SKROBEK. Ibid., 49(7): 253-256 (July 1977).
The authors describe the measurement of the deflections of a reinforced concrete post by recording subsequent load stages on a single photographic plate. (In Polish)
150. Zalety analitycznego opracowania fotogrametrycznego przy pomiarach przestrzennych konstrukcji mechanicznych. By A. BUJAK-IEWICZ and R. PREUSS. Ibid., 49(8): 293-295 (August 1977).
The Zeiss (Jena) phototheodolite 19/1318 and UMK camera 10/1318 were used to obtain stereophotography of a mechanical crane. An analytical method was employed to measure deflections during use. (In Polish)
151. Fotogrametryczny pomiar odkształceń statku skutek wodowania i

zmian termicznych. By B. SZCZECZOWSKI. Ibid., 51(2): 30-32 (February 1979).

A description is given of photogrammetric measurements of ship deformation caused by the launch procedure and by thermal changes. (In Polish)

152. Fotogrametria w przemyśle stoczniovym. By J. BŁĘDZKA. Ibid., 51(4): 8-13 (April 1979).

This paper gives a review of applications of photogrammetric methods to ship construction and discusses the accuracies achieved. (In Polish)

153. Określenie zmian kształtu lotni w locie metodami fotogrametrii analitycznej. By G. RYCHLEWSKI. Ibid.: 21-24.

The determination of the shape changes of a flexible wing manned vehicle during flight has been determined by an analytical photogrammetric method. (In Polish)

154. Photogrammetric methods in civil engineering research. By R.F. SEVERN, in: Remote sensing of the Terrestrial Environment, Ed. R.F. Peel, L.F. Curtis and E.C. Barrett. Butterworths, Pages 182-188.

The following three distinct uses of photogrammetry have found application in civil engineering research at Bristol University. (1) Where a single, stationary camera is used to take photographs of an experiment which is either changing slowly (relative to the exposure interval), or which is changing discontinuously. Separate photographs then record the experimental situation at different times. (2) Where a pair of linked cameras, separated by a known fixed distance, take a simultaneous stereo-pair of photographs of the experiment. (3) Where a single camera takes a time-lapse photograph of a relatively slowly changing situation, so that streak-lines are produced.

155. Dulni fotogrametrie - soucastnost a perspektivy. (Mining photogrammetry - present and future). By J. VLCEK. Rudy, 25(12): 344-352 and 377-378 (1977).

A Zeiss SMK stereophotogrammetric camera was used for the surveys and, for the illumination of inaccessible walls, use was made of lasers. Photographs of the equipment for laser stereophotogrammetry, formulae for the calculation of errors in the position of the points to be determined and a table listing the values of these errors are given. The defects of the SMK camera are pointed out. A new camera for stereophotogrammetric survey, designed by the IOR is described. A photogrammetric method for the determination of deformations in underground constructions is briefly explained, indicating the camera types used, the location schemes of the sedimentary signs and assumed r.m.s. errors of deformation.

156. Methodology of repeated terrestrial stereophotogrammetric survey. By F.V. NIKULIN. Sklonovye processy (Moscow University): 54-98 (1977).

The following subjects are analysed: Instruments and equipment for photogrammetric observations in stationary observation posts on slopes; choice of survey bases and equipment of photographic camera stations with fixed signals; marking of tie points and indicators, geodetic observations;

phototheodolite survey, terms for repeated surveys and intervals between them; application of phototheodolite survey data in detailed geological-geomorphological mapping: comparison of simultaneous photographic surveys; restitution methodology for repeated surveys by the method of pseudoparallaxes. (In Russian)

157. Photogrammetry in the measurement of structural deformation in box girders. By P.J. SCOTT. The South African Journal of Photogrammetry, 9(1): 31-38 (1977).
This paper describes two structural deformation projects and the research which they necessitated into close focus camera calibration and the lens process. Both projects consisted of a successive load test to failure of a box girder.
158. Measurement of tunnel surface roughness by close-range photogrammetry. By G.E. MARRIOTT. The South African Survey Journal, 15(91): 56-58 (April 1976).
A laboratory photogrammetric technique has been developed for the production of contour maps and profiles of a rock tunnel wall as an aid to assessing the hydraulic roughness of its surface.
159. Palatal analysis by a stereo photogrammetric method. By L.P. ADAMS. Ibid., 15(93:6): 35-49 (December 1976).
The author discusses the use of close range photogrammetry as a method of measuring human palates. He describes the method of camera calibration and how the normal principal distance of the available camera was increased. The photogrammetric analysis is discussed with reference to a typical set of measurements.
160. Stereophotogrammetric survey of engineering explosions. By M.A. BLJUMIN, in: Stereofotogrammetriceskaja s'emka inženernykh vzryvov: 3-93 (1977).
A methodology is explained for the stereophotogrammetric survey of engineering explosions, by which the trajectory elements of rock blocks moving according to a ballistic trajectory can be determined. Calculations of survey parameters, peculiarities of the photogrammetric restitution of stereopairs of motion pictures and algorithms of the mathematical processing of the measuring results are stated. (In Russian)
161. Terrestrial photogrammetry: an application in civil engineering. By A.D. HAWKSEY. The Surveying Technician, 4(1): 18-21 (February 1976).
The article deals with some aspects of the use of non-topographic photogrammetry in dimensional analysis of parts of oil rig structures.
162. Three-dimensional control of ship constructions. By H. HAGGREN, M. MARTIKAINEN, H. SALMENPERÄ, H. VEHKAPERÄ and S. VÄÄTÄINEN. Building Technology and Community Development (Technical Research Centre of Finland), 13: 23 pages (1978).
This publication describes a project in which the shape, size and compatibility of two shipblocks were measured using three different metric cameras. The photogrammetric results were compared with results obtained by geodetic measuring

methods. The paper includes some examples of the graphical presentation of the results obtained with a digital plotter.

163. A note on a use of stereophotography in tunnelling. By G.WEST. Transport and Road Research Laboratory Report SR 211 UC, Crowthorne, 1976. 16 pages.

Stereophotography offers a means of recording and measuring the profile of a section of a tunnel face. The method is described and selected stereopairs illustrating the cutting patterns on the faces of tunnels in chalk produced by pick and disc cutting tools are presented, together with profiles obtained from these.

164. Terrestrial photogrammetric surveys of unstable terrain in Colombia. By W. HEATH, L.L. PARSLEY and J.W.F. DOWLING. Transport and Road Research Laboratory Report 816, Crowthorne, 1978. 39 pages. Illustrated.

As part of a general investigation into road building problems in steep mountainous terrain in Colombia, a study was made to determine how a terrestrial photogrammetric technique could best be used to measure landslide surface features. The Wild P32 camera was found to give adequate accuracy for this work and complete photogrammetric surveys at scales ranging from 1 : 200 to 1 : 5000 were made on 80 landslide sites within a ten week period.

165. A preliminary study of the reproducibility of joint measurements in rock. By G. WEST. Transport and Road Research Laboratory Supplementary Report 488, Crowthorne, 1979. 9 pages + 4 diagrams and 2 plates.

An investigation has been made into the reproducibility of measurement of joint frequency and orientation in the Lower Chalk. The opportunity was also taken to compare measurement of joint frequency made from stereophotographs with measurement made on site. It was found that measurement of joint spacing was a subjective matter, the joint distribution diagrams being different for different observers. However, measurements from stereophotographs showed no more variation than site measurements.

166. Tunnel profiling by photography. By S. FELLOWS. Tunnels and Tunnelling, 8(3): 70-73 (May 1976).

A single camera method of measuring tunnel profiles is described. Operation times are very quick but no accuracies are quoted.

167. Rasterstereografie. Ein fotogrammetrisches Verfahren zur Vermessung von Körperoberflächen durch ein aufprojiziertes Raster. By W. FROBIN and E. HIERHOLZER. Universität Münster Sonderforschungsbereich 88/C1, 16: 23 pages (November 1978).

Rasterstereography is a simplified stereophotogrammetric method for the measurement of body surfaces. The equipment consists of a projector with a grid slide and a camera. The grid is projected on to the surface to be measured. The photograph and the grid slide effectively form a stereopair and thus only one photograph has to be measured. The reconstructed body surface is calculated by a computer and can be represented on a graphic display or plotter in arbitrary angular positions. (In German)

168. Rechenmethoden zur analytischen Auswertung fotogrammetrischer Stereobildpaare. By W. FROBIN and E. HIERHOLZER. Ibid., 18: 53 pages (January 1979).
Methods of calculation for the analytical evaluation of photogrammetric stereopairs are discussed. Both the bundle method and a solution by alternating orientation and reconstruction are considered. (In German)
169. Überlegungen zur nomografischen Auswertung von Moire-Topogrammen. By B. DRERUP. Ibid., 20: 35 pages (June 1979).
Surfaces with overlaid contour lines can be generated by moire topography. The direct measurement of distances and angles in the space interspaced with contour planes is discussed. For the determination of these quantities scales and nomograms are printed on a transparent ruler, which can be laid over the topogram. The effect of motions of a rigid body on the fringe patterns is also studied. (In German)
170. Rasterstereografie. Krümmungsanalyse Invariante Beschreibung der Körperoberfläche durch ihre Krümmung. By W. FROBIN and E. HIERHOLZER. Ibid., 21: 45 pages (July 1979).
An analysis of the data obtained by rasterstereography, or by other methods of body surface measurement, is given. The main difficulty is to work out the intrinsic properties of the body shape and to eliminate the effects of an arbitrarily chosen co-ordinate system. (In German)
171. The application of photogrammetry to the recording of monuments and sites in Australia. Bulletin 42, Department of Surveying, University of Melbourne, 1977. 79 pages. Illustrated.
In addition to a general review of activities in the field of architectural photogrammetry, the aims of this project were to conduct technical investigations into the equipment, materials and techniques involved and to undertake pilot projects in a variety of different applications.
172. Genauigkeitsschätzung bei terrestrischen Überweitwinkelkamern. By J. RADY. Vermessung, Photogrammetrie, Kulturtechnik, 75(11): 358-359 (November 1977).
The use of new types of cameras for terrestrial photogrammetry requires a change in the positioning of the camera stations and a new estimation of the errors. The theoretical precision of the Wild P31/45 super wide angle camera is investigated. Formulae are derived for the error of a point in a plane perpendicular to the direction of greatest ground slope. (In German)
173. Bestimmung der Ausbruchflächen anhand photographischer Aufnahmen. By R. LÜTZELSCHWAB. Ibid., 76(7): 180-184 (July 1978).
The author describes apparatus which has been developed whereby surface cross sections in a road tunnel can be quickly and simply obtained by a photographic method. Successive sections of the tunnel are illuminated in turn by a laser beam. (In German)
174. Dokumentation von Kunstgegenständen mittels Nahphotogrammetrie. (The documentation of art objects by means of close-up photogrammetry). By H. KASPER and G. KASPER. Ibid., 76(10): 291-294

(October 1978).

It is important to fully document art objects because of the dangers of theft, falsification and the needs for restoration and documentation. Dimensions and colour must be very carefully and completely recorded. The Wild P32 apparatus has proved ideal for this. Kasper describes work in the Swiss Landesmuseum and the Institut für Denkmalpflege at the Technical High School in Zurich.

175. Einige Gedanken zu Fragen der Industriephotogrammetrie. (Some reflections on problems of industrial photogrammetry). By J. TÖPPLER. Vermessungs-Information, 32: 2-8 (1976).
Proceeding from the fact that industrial photogrammetry is to be put on a level with terrestrial photogrammetry and aerial photogrammetry with respect to its fields of application, the author deals with its characteristics in regard of the imaging conditions, base ratio, application of convergent photogrammetry, accuracy, object structuring, control points and computing programs.
176. Demonstration einiger beim VEB Carl Zeiss Jena durchgeführten Applikationsbeispiele. (Demonstration of some examples of application carried out in the Jena works). By J. TÖPPLER and G. VOSS. Ibid.; 9-16.
The authors present some practical examples of the application of industrial photogrammetry undertaken by Zeiss (Jena). In the first instance, examples of vehicle construction are given such as model measurements, photographing and evaluating crash tests, dynamic driving tests and measurements of tyre deformations. The article contains descriptions of photogrammetric measurements for determining the track ring axis of a rotary furnace and provides information as to the determination of the creasing of cloths in an analytical and graphical way. It ends with an example of animal measurements.
177. Eine Überweitwinkel-Messkammer für die Architektur-Photogrammetrie. By R. MEYER. Vermessungstechnik, 24(2): 62-64 (February 1976).
The article describes a prototype camera from Zeiss (Jena), the AMK 7/1824. It has a super-wide angle ($f = 70$ mm) lens and a format of 180 X 240 mm. (In German)
178. Schwingungsmessungen am Fernseh- und UKV-Turm Berlin. By P. SCHMIDT. Ibid., 24(6): 211-214 (June 1976).
The author describes the development of a method, based on terrestrial photogrammetric principles, for observing movement parameters of tower shaped structures. (In German)
179. Photogrammetrische Messung des Geschwindigkeits profils in einem Flüssigkeitsstrom. By H. VOIGT and W. GUSKE. Ibid., 24(7): 254-257 (July 1976).
The theoretical basis of a stereophotogrammetric method of determining fluid flow is described and a practical example is given. (In German)
180. Zur photogrammetrischen Erfassung der Oberflächenform von Sportbooten und angeströmten Segeln. By H.-U. SCHULZ. Ibid., 24(8): 312-314 (August 1976).

The author describes the testing of various surveying instruments and plotting methods for calculating photogrammetric space co-ordinates of the sails of yachts. (In German)

181. Zur Vermessung kleiner räumlicher Objekte mittels holographischer Technik. By W. REICHEL, W. GAUERT and R. -I. STOHN. Ibid., 24(11): 412-414 and 462-466 (November 1976).
The authors discuss the accuracy of measurement of the holographic method of surveying and suggest possibilities for its practical application. A comprehensive list of references is given at the end of the article. (In German)
182. Mathematische Modelle für die Kalibrierungsdaten terrestrisch-photogrammetrischer Messkamern und der Einfluss der „Restfehler auf das stereophotogrammetrische Ergebnis. By G. WURTZ. Ibid., 25(3): 93-94 (March 1977).
The author examines mathematical models for calibration data of survey cameras used for terrestrial photogrammetry and discusses the influence of residual errors on the stereo-photogrammetric result. (In German)
183. Höhenmässige Aufnahme von Ablaufanlagen der Deutschen Reichsbahn mit Hilfe der terrestrischen Photogrammetrie. By W. PRÖMMEL and U. BRENNER. Ibid., 25(8): 267-270 (August 1977).
The paper describes an application of terrestrial photogrammetry to surveys of railway gradients which has advantages over conventional surveys in terms of safety and access. (In German)
184. Der Einsatz des Neigungsrechners des VEB Carl Zeiss Jena für die Auswertung verschwenkter terrestrischer Aufnahmen. By H. -J. DÜRNFELD and J. TÖPPLER. Ibid., 25(11): 383-386 (November 1977).
A description is given of the use of the Zeiss (Jena) inclination calculator in plotting oblique terrestrial photographs. It has particular advantages for architectural photogrammetry. (In German)
185. Die Photogrammetrie im System der Denkmalpflege. By R. MEYER. Ibid., 26(2): 52-54 (February 1978) and 26(3): 97-100 (March 1978).
The author discusses the place of photogrammetric measurement techniques within a system of monument preservation. (In German)
186. Das Problem der gefährlichen Flächen bei der Anwendung von Modellverfahren in der Industriephotogrammetrie. By W. GUSKE. Ibid., 26(6): 200-201 (June 1978).
The author has examined the orientation problem which can arise, in close range photogrammetry, when a situation occurs which is analogous to the "danger surface" of air survey in mountainous areas. (In German)
187. Bestimmung der gegenseitigen Orientierung von terrestrischen Stereobildpaaren mit Hilfe zweier Lotstrecken. By W. GUSKE. Ibid., 26(12): 422-424 (December 1978).
The author derives formulae for the determination of the mutual orientation of terrestrial stereopairs by means of two

- plummet distances and gives a theoretical accuracy estimate.
(In German)
188. Die Anwendung der Differentialentzerrung für die Herstellung von Fassadenplänen. By W. MARCKWARDT. Ibid., 27(1): 27-30 (January 1979).
The use of differential rectification in the preparation of plans of building façades is described, with particular reference to the procedures involved in the Zeiss (Jena) Topo-cart-Orthophot system. (In German)
189. Rechnergestützte Koordinatenmessung im Maschinenbau—ein Aufgabengebiet der Koordinatenmesstechnik und der Photogrammetrie. By W. LOTZE and K. REGENSBURGER. Ibid., 27(4): 114-117 (April 1979).
The author describes the computer aided measurement of coordinates required in machine building with the assistance of a photogrammetric technique. (In German)
190. Das System STEREO-VUGTK der analytischen photogrammetrischen Auswertung. Theorie und Anwendungsbeispiele aus Industrie und Bauwesen. By J. ŠIMA. Ibid.: 122-126.
The analytical plotting system STEREO-VUGTK developed in Czechoslovakia extends the possibilities of applying terrestrial photogrammetry to precise measurements such as deformation observations and assembly controls. The article is illustrated by photographs taken with a Zeiss (Jena) UMK 10/1318 camera of a bridge, a storage tank, a cooling tower and a block of flats. (In German)
191. Photogrammetrische Erfassung von Bauwerksveränderungen. (Photogrammetric registration of construction deformations). By J.P. ERLANDSON and S.A. VERESS. Vermessungswesen und Raumordnung, 38(8): 417-430 (1976).
A photogrammetric monitoring method was established to monitor external structural deformations. The method consists of simultaneous adjustment of the field survey and photogrammetric data, such as orientation angles and photographic coordinates. The method is flexible; thus aerial and terrestrial photographs can equally be used. The achievable accuracy is about 1 : 100 000 of the photographic distance. Three projects have been presented where monitoring started in 1973. The economy of the classical field survey and the photogrammetric method is about the same if only 5 to 10 points are to be monitored. If there is a larger number of points to be measured, the photogrammetric method proved to be more economical. The larger the number of points, the better the economy achieved.
192. Photogrammetrische Imperfektionsmessungen an Stahlbrücken unter Temperatureinfluss. (Photogrammetric measurements of imperfections on steel bridges under the influence of temperature). By K. HERTEL and H.O. SCHON. Ibid., 39(1): 11-15 (1977).
In continuation of former work, measurements of imperfections influenced by temperature had to be carried out by order of the Bundesanstalt für Strassenwesen on a sheet metal foot-bridge in the Moselle valley at Winnigen during a measuring

cycle of over 24 hours. The photogrammetric method proved to be the only possibility of recording all measuring points within a short time.

193. Photogrammetrische Bauwerkskontrolle an einem Brückenbauwerk aus Stahlbetonfertigteilen. (Photogrammetric building control on a bridge constructed from finished steel concrete parts). By K. HERTEL, H. -O. SCHON and S. WENZEL. Ibid., 40(1): 21-28 (1978).

Especially important for the exact determination of slight changes in buildings are reliable and invariable fixed points, such as those available in the present case in the form of deeply founded piers. On account of local conditions, photogrammetric measurement was applied here only for the determination of building changes in the profile plane, whereas possible changes in the axial direction of the arch were checked by means of geodetic plumbing. If local conditions permit, these measurements too can be determined photogrammetrically without considerable additional cost. The accuracy of 4 mm and the short measuring time (4 to 5 hours) required by the highway constructing office of Bonn were achieved.

194. Fassadenzeichnung mit Hilfe photographischer Aufnahmen. (Façade drawing with the aid of photographic surveys). By G. ECKSTEIN. Ibid., 40(2): 49-61 (1978).

It is stated that façade drawing does not attain the quality of a photogrammetric survey, but is by far superior to conventional manual surveying.

195. Photogrammetric survey of a Pyrgos in Greece. By J. BADEKAS. Veröffentlichung, Geodätischen Institutes Rheinisch-Westfälischen Technischen Hochschule Aachen, 23: 1-12 (1977).

Description of the photogrammetric survey of a castle ruin, known as Pyrgos and situated on the island of Kramai, the southern part of the Peloponnesus near the town of Githion. The façades of all four exterior walls had to be surveyed. As the height of the tower could not be recorded with one survey, it was decided to use tilted photographs of 15°. Rectification was carried out of the standard and tilted photographs, which were used in the Stereoplanigraph. The graphical restitution in the Stereoplanigraph was combined with photographic rectification, so that detailed maps for each of the four façades were obtained.

196. Le rôle de la photogrammétrie dans les grands projets internationaux de sauvegarde des monuments et des sites. (The part of photogrammetry in major international projects of monument and site preservation). By M. CARBONNELL. Ibid.: 13-31.

The author describes photogrammetric inventory surveys of monuments and works of art in Greece, Indonesia and Egypt, the methods of which are investigated by order of UNESCO.

197. Die zerstörte Kölner 'Dommonstranz' und das erste deutsche Fahndungsmessbild. (The destroyed Cologne cathedral monstrance and the first German search photogram). By C.W. CLASEN. Ibid.: 33-46.

The object of photogrammetric survey was a work of goldsmiths' art from 1657, a monstrance of pure gold, set with

numerous precious stones, which contains a rock crystal vessel closed with a cupola and two crowns. This work of art was stolen in November 1975 and completely destroyed. From numerous photographs and two accidentally available stereophotographs, a pictorial reconstruction at scale 1 : 1 was carried out, the preparation of which is described in detail and forms the foundation for the construction of a true copy. An approved goldsmith was charged with this task.

198. Vorschläge zur Verbesserung der Informations-Gewinnung in der Architektur-Photogrammetrie. (Proposals for the improvement of data acquisition in architectural photogrammetry). By M. DOHLER. Ibid.: 47-55.

In the last few years, the author has had the occasion to survey photogrammetrically archaeological objects in various places of Europe, north Africa and Asia Minor, which were different as to type and task. It has appeared that the means of data acquisition (methods, instruments and appliances for taking photographs) which suffice for the tasks of monument preservation, do not meet the very different requirements of archaeology. Based on the experience obtained, some proposals are made for improvement of the photogrammetric surveying technique which may also be important for other work in architectural photogrammetry.

199. Photogrammetrische Beweissicherungsaufnahme. (Photogrammetric evidence securing survey). By H. FORAMITTI. Ibid.: 57-64.

The author discusses problems of stability which lead to changes in shape, the preservation of old settlements, civil houses, national architecture, archaeological emergency excavations and salvage actions, restorations and the importance of photograms as search documents after thefts of art. In conclusion, the author makes proposals for securing evidence, in order to keep representative the stocks of photogrammetric files of cultural goods.

200. Architektur-Photogrammetrie und moderne Stadtbauplanung. (Architectural photogrammetry and modern urban planning). By G. FROHBERG. Ibid.: 65-73.

The complex preservation of monuments is dealt with in connection with town and building planning.

201. Überlegung zum Einsatz eines modernen Aufnahmesystems in der terrestrischen Photogrammetrie. (Considerations on the use of a modern camera system in terrestrial photogrammetry). By L. HARDEGEN. Ibid.: 75-86.

The development of new cameras for terrestrial photogrammetry allows photogrammetrists to adapt themselves in an optimum way to almost any data collection situation. Using different focal length lenses, a full size object representation and thus a largest possible taking scale can be guaranteed in nearly all cases. Colour-corrected lenses with a high resolution and low distortion make possible photographs of a high optical and geometric quality. The results obtained confirm other theoretical considerations and are a proof of the efficiency of using the new camera system in terrestrial photogrammetry, especially in the field of architectural photogrammetry, monument preservation and archaeology.

202. Zur Bildgeometrie einer Wild P32 und Ihrer Einsatzmöglichkeit in der Architekturphotogrammetrie. (On the image geometry of a Wild P32 and its applicability in architectural photogrammetry). By G. KUPFER and W. WESTER-EBBINGHAUS. Ibid.: 87-103.
The possibilities of using a Wild P32 camera, for various technological applications are briefly explained. The use of the camera with film and plate material was tested as to the accuracy to be expected by means of calibration measurements. When using a réseau, geometric results of a good precision can be obtained, even with conventional films. Even without high expense, good multipurpose results can be obtained with this camera for most requirements, especially in the field of architectural photogrammetry.
203. Photogrammetrische Forschungsarbeiten an Schloss Linderhof. (Photogrammetric research work on Linderhof Castle). By G. NAGEL. Ibid.: 105-121.
The author describes the application of orthophotography in the façade and interior room surveying of Linderhof Castle, as well as terrestrial completion surveys (fixation of axes, measurement of polygon traverses, determination of over 300 control points) and the restitution operations of the 228 stereomodels for 4 years, with interruptions, on the Zeiss Terragraph.
204. Photogrammetrische Dokumentation von Kunstgegenständen. (Photogrammetric documentation of objects of art). By H. KASPER and G. KASPER. Ibid.: 123-131.
It is shown with the example of a madonna statuette that the Wild P32 is also highly suitable for close-range photogrammetric high precision documentation of objects of art, such as statuettes, monstrances, goblets and chalices. Application fields: securing documentation for the preservation of cultural goods, an aid for art historical research, as a proof of identity and a restoration base.
205. Beitrag zur Industrievermessung mit einfachen photogrammetrischen Hilfsmitteln. (A contribution to industrial survey with simple photogrammetric means). By B.G. MÜLLER. Ibid.: 201-210.
Many industrial objects can be recorded more efficiently by means of photogrammetry than by geodetic methods. An appropriate procedure is outlined by which two conventional plate cameras are used in combination with a computer assisted simple measuring microscope. As an alternative, the possibilities of roll film in combination with Wild P32 or Rolleiflex cameras are described. The paper also describes the development of an analytical instrument through digitising by a stereocomparator with connection to a desk calculator system, so improving the measuring accuracy.
206. Rock paintings in Australia. By N. CLOUTON. Wild Reporter, 12: 2-3 (1977).
Application of photogrammetric methods in recording rock engravings in central Australia and paintings discovered in some big rock galleries on the Cape York peninsula. Use of a Wild C 120 stereometric camera; restitution on the Wild A 40 at scales 1 : 10 and 1 : 20. Measures taken for scale control and the selection of control points are briefly reported.

207. Recording construction disasters. By P. WALDHÄUSL. Ibid.: 4.
 With a Wild C40 camera set up on a special platform, the broken pillar of a bridge was photographed from the downstream side from a distance of only 2.5 m. The bridge had steel supports embedded in the top of the concrete pillar. These supports sheared off when the bridge collapsed. The position of the supports and the angle of shear were determined from the stereomodel.
208. Erfassung und Eliminierung der Orientierungsfehler von Stereobildpaaren in der Industrie-photogrammetrie. (Determination and elimination of the orientation errors of stereopairs in industrial photogrammetry). By K. REGENSBURGER. Wissenschaftliche Zeitschrift (Technische Universität Dresden), 26(6): 1265-1270 (1977).
 The orientation and elimination of the orientation errors arising in photogrammetric surveying play an essential part in industrial photogrammetry. The present research should provide a contribution to the optimum selection of known orientation methods when using photogrammetric cameras.
209. Numerische Auswertung und Statistische Analyse von ingenieur-photogrammetrischen Deformationsmessungen. (Numerical evaluation and statistical analysis of engineering photogrammetric deformation measurements. Thesis. Technical University, Hannover). By U. BUCK. Wissenschaftliche Arbeiten des Lehrstuhls für Geodäsie, Photogrammetrie und Kartographie. Technische Universität Hannover, 82. 182 pages (1978).
 Error-theoretical considerations and tests of survey dispositions relevant for practice confirm the fundamental suitability of terrestrial phototriangulation for deformation measurements of high accuracy. A geodetically defined test field on the stands of the Lower Saxony stadium, Hannover, serves to provide a proof, which is theoretically difficult, of the stochastic model conformity of the extended hybrid bundle adjustment program and of the statistical method of deformation analysis.
210. Photogrammetrische Punktbestimmung und Bauaufnahme im Limburger Dom. By R. -D. DÜPPE and E. KUTSMICHEL. Zeitschrift für Vermessungswesen, 104 (5): 203-208 (May 1979).
 In connexion with current construction and renovation works in Limburg Cathedral, photogrammetric point determination, subsequent mapping and archival recording of the cathedral interior were all performed with a stereometric camera. The horizontal and vertical control network had an accuracy of ± 10 mm and the point accuracy resulting from photogrammetric network densification using a newly developed independent model triangulation program was ± 15 mm. (In German)

Proceedings of ISP Commission V Inter-Congress Symposium Photogrammetry for Industry, published as International Archives for Photogrammetry, 22(5), 1978.

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