

GLENN B. SINCLAIR

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EDUCATION

Ph.D., Applied Mechanics, California Institute of Technology (1972). B.E., Engineering Science, University of Auckland (1969). B.Sc., Mathematics, University of Auckland (1967).

ACADEMIC EXPERIENCE

Groves-Hodge Professor of Mechanical Engineering, Louisiana State University (2008-present); Juneau Professor of Mechanical Engineering, (2001-2008); Chairman of Department (2001-2003, 2004-2008).

Professor of Mechanical Engineering, Carnegie Mellon University (1982-2000); Head of Department (1986-1992); Associate Professor (1980-1982); Assistant Professor (1977-1980).

Visiting Professor, Cambridge University Engineering Department, England (1981); Lecturer in Theoretical and Applied Mechanics, University of Auckland, New Zealand (1974-1977); J. Willard Gibbs Instructor in Engineering and Applied Science, Yale University (1972-1974).

INDUSTRIAL EXPERIENCE

Consultant in structural design, and stress and failure analysis. Clients include major US corporations (Black & Decker, DEC, Du Pont, GE, Honeywell, Pepsico, PPG, Trinity Industries, United Technologies, USX, Westinghouse), a number of smaller local US companies (e.g., CALGON, ANSYS), as well as various government agencies in the US (1974-present). Summer Professor with Pratt & Whitney Aircraft Corporation, engaged in numerical stress analysis and cyclic life prediction (1978 & 1979).

Consultant on simulation and linear/non-linear programming techniques for local government and various local companies in Auckland, New Zealand (1974-1977). Analyst with the Department of Scientific and Industrial Research, New Zealand, engaged in statistical assessment and stress analysis (1968 & 1969).

RESEARCH EXPERIENCE

Asymptotic identification of singular stress fields, assessment of linear elastic fracture mechanics, development of new approaches to fracture mechanics: analysis of contact problems, tribology: development of new algorithms for finite element and integral equation methods, verification of numerical methods: static and dynamic structural analysis (1974-present). Scheduling problems, simulation techniques, operations research (1974-1977).

TEACHING EXPERIENCE

Undergraduate courses taught: Fundamentals of Mechanical Engineering, Statics and Dynamics, Dynamics of Physical Systems, Mechanics of Deformable Solids, Aircraft Structural Analysis, Stress Analysis, Fracture Mechanics, Fluid Mechanics, Design of Machine Components, Manufacturing Processes, Engineering Analysis, Systems Analysis, Numerical Methods, Engineering Mathematics, Statistics, Calculus, Physics.

Graduate courses taught: Introduction to Solid Mechanics, Theoretical Elasticity and Plasticity, Wave Propagation in Solids, Deformation and Fracture of Engineering Materials, Interface Mechanics, Conductive and Radiative Heat Transfer, Advanced Engineering Analysis, Operations Research, Numerical Methods, Integral Equation Analysis, Finite Element Applications, Mathematical Physics, Complex Variables.

PERSONAL INFORMATION

Born – 7 March 1946 in Auckland, New Zealand. Citizenship – United States. Married, four children. Excellent health.

SELECTED RECENT PUBLICATIONS

The publications listed next are separated into the following areas: fracture mechanics, contact mechanics, numerical analysis, and other topics. The four papers that have not yet been published are included to reflect current interests further: the three conference contributions are likewise included.

Fracture mechanics

Singularity identification

G.B. Sinclair, “Logarithmic stress singularities resulting from various boundary conditions in angular corners of plates in extension,” *Journal of Applied Mechanics*, Vol. 66, pp. 556-560 (1999).

G.B. Sinclair, “Logarithmic stress singularities resulting from various boundary conditions in angular corners of plates under bending,” *Journal of Applied Mechanics*, Vol. 67, pp. 219-223 (2000).

G.B. Sinclair, “Stress singularities in classical elasticity-I: Removal, interpretation, and analysis,” *Applied Mechanics Reviews*, Vol. 57, pp. 251-297 (2004).

G.B. Sinclair, “Stress singularities in classical elasticity-II: Asymptotic identification,” *Applied Mechanics Reviews*, Vol. 57, pp. 385-439 (2004).

Singularity removal

G.B. Sinclair, “On the influence of cohesive stress-separation laws on elastic stress singularities,” *Journal of Elasticity*, Vol. 44, pp. 203-221 (1996).

G.B. Sinclair, “A note on the influence of cohesive stress-separation laws on elastic stress singularities in antiplane shear,” *Journal of Elasticity*, Vol. 94, pp. 87-93 (2009).

G.B. Sinclair, G. Meda and B.S. Smallwood, "On crack-tip stresses as crack-tip radii decrease," *Journal of Applied Mechanics*, under review (2008).

E.R. Lewis and G.B. Sinclair, "On the removal of stress singularities from butt joints," *Proceedings of the Twenty-First Canadian Congress of Applied Mechanics* (abstract only), Toronto, Ontario, pp. 674-675 (2007).

Projects funded by the National Science Foundation (NSF), Air Force Materials Laboratory, Pratt & Whitney Aircraft Corp., and ExxonMobil Chemical Co.

Contact mechanics

Dovetail attachments in gas turbines

G.B. Sinclair, N.G. Cormier, J.H. Griffin and G. Meda, "Contact stresses in dovetail attachments: finite element modeling," *Journal of Engineering for Gas Turbines and Power*, Vol. 124, pp. 182-189 (2002).

G.B. Sinclair and N.G. Cormier, "Contact stresses in dovetail attachments: physical modeling," *Journal of Engineering for Gas Turbines and Power*, Vol. 124, pp. 325-331 (2002).

G.B. Sinclair and N.G. Cormier, "Contact stresses in dovetail attachments: alleviation via precision crowning," *Journal of Engineering for Gas Turbines and Power*, Vol. 125, pp. 1033-1041 (2003). This paper is the basis of US Patent 6,244,822 B1 issued in 2001 and UK Patent GB 2,345,943 B issued in 2003.

J.R. Beisheim and G.B. Sinclair, "On the three-dimensional finite element analysis of dovetail attachments," *Journal of Turbomachinery*, Vol. 125, pp. 372-379 (2003).

J.R. Beisheim and G.B. Sinclair, "Three-dimensional finite element analysis of dovetail attachments with and without crowning," *Journal of Turbomachinery*, Vol. 130, pp. 021012-1-021012-8 (2008).

Projects funded by GE Aircraft Corp., ANSYS Inc., and the Office of Naval Research.

Microcompression molding

W.J. Meng, D.M. Cao and G.B. Sinclair, "Stresses during micromolding of metals at elevated temperatures: pilot experiments and a simple model," *Journal of Materials Research*, Vol. 20, pp. 161-175 (2005).

J. Jiang, W.J. Meng, G.B. Sinclair and E. Lara-Curzio, "Further experiments and modeling for microscale compression molding of metals at elevated temperatures," *Journal of Materials Research*, Vol. 22, pp. 1839-1848 (2007).

J. Jiang, G.B. Sinclair and W.J. Meng, "Quasi-static normal indentation of an elasto-plastic substrate by a periodic array of elastic strip punches," *International Journal of Solids and Structures*, under review (2008).

Project funded by NSF.

Numerical analysis

Numerical methods

D.B. Cooper, G. Meda and G.B. Sinclair, "A comparison of crack-flank displacement fitting for estimating K with a path independent integral," *International Journal of Fracture*, Vol. 70, pp. 237-251 (1995).

G. Meda, T.W. Messner, G.B. Sinclair and J.S. Solecki, "Path-independent H integrals for three-dimensional fracture mechanics," *International Journal of Fracture*, Vol. 94, pp. 217-234 (1998).

N.G. Cormier, B.S. Smallwood, G.B. Sinclair and G. Meda, "Aggressive submodelling of stress concentrations," *International Journal for Numerical Methods in Engineering*, Vol. 46, pp. 889-909 (1999).

G.B. Sinclair and B.P. Epps, "On the logarithmic stress singularities induced by the use of displacement shape functions as boundary conditions in submodelling," *Communications in Numerical Methods in Engineering*, Vol. 18, pp. 121-130 (2002).

Projects funded by ANSYS Inc. and GE Aircraft Corp.

Verification

G.B. Sinclair, M. Anaya-Dufresne, G. Meda and M. Okajima, "Tuned test problems for numerical methods in engineering," *International Journal for Numerical Methods in Engineering*, Vol. 40, pp. 4183-4209 (1997).

G.B. Sinclair and J.R. Beisheim, "Simple convergence-divergence checks for elastic stress analysis with finite elements," *International Journal for Numerical Methods in Engineering*, under review (2008).

G.B. Sinclair, J.R. Beisheim and S. Sezer, "Practical convergence-divergence checks for stresses from FEA," *Proceedings of the 2006 International ANSYS Conference*, Pittsburgh, Pennsylvania, on CD-ROM, 50 pp. (2006).

G.B. Sinclair and J.R. Beisheim, "Alternative convergence-divergence checks for stresses from FEA," *Proceedings of the 2008 International ANSYS Conference*, Pittsburgh, Pennsylvania, on CD-ROM, 22 pp. (2008).

Funding being sought from the National Institute of Standards and Technology.

Other Topics

G.B. Sinclair, "Further paradoxes in generalized Levy problems," *Journal of Elasticity*, Vol. 50, pp. 253-259 (1998).

G.B. Sinclair and G. Meda, "A note on some anomalies in Lamé's solutions for elastic solids with holes," *Journal of Applied Mechanics*, Vol. 68, pp. 132-134 (2001).

M. Anaya-Dufresne and G.B. Sinclair, "Towards a Reynolds equation for gas lubricated bearings when contact occurs," *Journal of Tribology*, Vol. 124, pp. 266-273 (2002). Project funded by an industrial consortium of data storage companies.

A.T. Assaad and G.B. Sinclair, "Some applications of integrated elasticity," *Journal of Applied Mechanics*, Vol. 74, pp. 210-222 (2007). Project initially funded by the Air Force Office of Scientific Research.

The foregoing research has been presented at other national and international conferences (International Gas Turbine Conference, International Congress of Theoretical and Applied Mechanics, International Symposium on Plasticity, Society of Engineering Science Annual Technical Meeting, US National Congress of Applied Mechanics). It has also been presented as seminars at universities (Caltech, Carnegie Mellon University, Duke University, Georgia Tech, Harvard University, Iowa State University, Stanford University, University of Kentucky, University of Massachusetts in the US; University of Auckland, University of Canterbury in NZ; Cambridge University, University of Wales in the UK; and Simon Bolivar University in Venezuela) and in industry and at a national laboratory (ANSYS, Corning Inc., GE Aircraft Corp., Pratt & Whitney Aircraft Corp., United Technologies Inc., and the Air Force Materials Laboratory).

Other research has lead to 52 journal publications and a like number of conference contributions (details furnished on request). This other research has been funded by federal agencies (Air Force Office of Scientific Research, Air Force Materials Laboratory, Department of Energy, NSF), industry (Badger Industries, Best Industries of Japan, Citgo, DEC, Pratt & Whitney Aircraft, USX), and foundations (Benedum, Ford).