



**WEILI CHENG, Ph.D.**  
**Mechanical Engineer**

### **Bio/Summary**

Dr. Cheng has over 30 years of experience in stress analysis and stress distribution, crack propagation and experimental methods for measurement of residual axial stresses in vessels ranging from thin-walled cylinders, water quenched parts, sandwich-brazed plates and omega shaped ring welds on steel blocks. He is an expert in bearing grooves of axles, pyrolytic carbon-coated graphite leaflets in cardiac devices; measurements of dynamic responses such as the Golden Gate Bridge and deformation of natural gas pipe lines. He also has up-to-date knowledge on thermal solar power generation and thermal storage design as well transient thermal-hydraulic modeling.

### **Select Industry Experience**

- Oil & Gas Industry
- Construction
- Manufacturing
- Maritime
- Thermal Hydraulic Modeling
- Stress Analysis
- Dynamic Analysis
- Medical Devices
- Bearings
- Design
- Programming
- Computation
- Failure Analysis
- Thermal Solar Power
- Thermal Storage

### **Education**

Ph.D. in Mechanical Engineering from U.C. Berkeley

M.S. in Mechanical Engineering from U.C. Berkeley

B.S. in Mechanical Engineering from Northwest Light Industry Institute, China

### **Relevant Experience**

#### **2010-2013 Advisory Engineer and Senior Expert at Areva Solar**

Transient two-phase thermal hydraulic modeling for solar direct steam generators.  
Optimization of concentrated solar steam generators (SSG).

#### **2008-2010 Senior Researcher at Ausra**

Research and development of thermal storage for SSG. Modeling and analysis of thermal storage. Modeling of load matching using solar and wind power with thermal storage.



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**2009-2010 Consultant for EPRI**

Weld residual stresses and stress relaxation due to shot-peening.

**1998 – Present, Senior Mechanical Engineer, Berkeley Engineering And Research, Inc.**

**Engineering Measurements:** Measurement of residual stresses in various configurations; Water quenched cylinders; Laser treated parts; Sandwich-brazed plates; hard surfaced specimens with different geometries; Omega-shaped ring welded on steel blocks; Gas-tungsten arc welded plate; Bearing groove of axles; Pyrolytic carbon-coated graphite leaflet in Cardiac devices; Pyrolytic carbon-coated graphite valve housing in Cardiac devices; Clad parts; Shot peened surface; Near surface residual stresses due to fire damage; measurement of dynamic response due to controlled explosions for the Livermore Lab; measurement of residual stresses due to fire damage to steel press; measurement of dynamic response of GM auto main press; measurement of the deformation of pressurized natural gas pipes for PGE; measurement and computation of membrane stresses of waterbeds; measurement of cracking of glass due to indenting and scribing; measurement of slip-stick vibration of sliding bearing; measurement of bolt stresses for Golden Gate Bridge Seismic Retrofit project.

**Engineering Analysis and Design:** Developed a new approach to compute stress intensity factors for both 2-D and 3-D bodies. The approach applies to a crack of arbitrary front and computations can be carried out by the finite element method without using crack elements or very fine mesh near the crack tip. Developed methods for measurement of residual stress distributions in different configurations of welds. Derived analytical solutions for the vibration of the U-bend tube bundle in cross-flow used to predict the wear and fatigue failure in steam generator tubes. Analysis and prediction of the fatigue fracture for a U-bend tube in a steam generator. Developed a model to predict the strength of glass due to subsurface flaws. Prediction of ductile fracture initiation in an experimental pressure vessel. Development of a model to predict stress concentration in a longitudinal welded pipe under creep conditions. Prediction of the influence of residual stresses due to shot peening on both the detection of fatigue cracks and their propagation in a titanium compressor disk. Prediction of burst pressure in a pipe due to plastic deformation in a region with reduced thickness. Analysis of the strain rate effect on the plastic instability. Prediction of the instability due to the creep deformation of a rotating part made by zinc-die-casting.

**Computer Programming and Applications:** Program for flange stress analysis using a FEM engine. Program for graphic mapping of laser scanned drum surface. Program for computation of transient hydraulic response. Program for digitizing graphic data. Programs for residual stress measurement for the slitting method using analytical solutions or 2-D finite element method. Programs for residual stress measurement for the single-slice method using 3-D finite element method. Finite element calculation of the effect of creep on burst pressure of piping at elevated temperature. 3-D finite



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element computation for the fracture analysis of a glass container. Finite element computation for wafer heating by electron beams. Finite element analysis of the magnetic field of a housing chamber. 3-D finite element computations for residual stresses due to different initial strain fields. Created a database for creep deformation. Analysis of the deformation of waterbeds. 3D FEM program including auto mesh generation, user interface for boundary conditions and material properties for coke drum stress analysis. Cylindrical surface generation using laser scanned data cloud.

**Engineering Reports:** Residual stress measurement for fillet pipe welds, PGE, 1993. Residual stress measurement and stress analysis for a bracket weld, EPRI, 1992. Fatigue analysis for a U-bend tube subjected cross-flow, EPRI, 1993. Vibration of U-bend tube bundle subjected to cross-flow, EPRI, 1994. Residual stress measurement for core shroud welds (River Bend), EPRI, 1996. Residual stresses in hard surfaced valve seats, Target Rock Corp. 1997. Measurement of residual stresses in Omega welds, Westinghouse, 1998. Measurements of Residual Stresses in BWR Core Shroud Support Welds, EPRI, 1999. Measurement of residual stresses in a GTAW welds, Bettis Lab, 2001. Measurement of Residual Stresses in Axles, Bombardier Transportation Holdings, Inc., 2002. Measurement of residual stresses in pyrolytic carbon coated graphite leaflets and housings, 2001. Thermal computation for semi-conduct wafer subject to e-beam heating, 2004-2005.

**Accident/Structural Analyses:** Lubrication and Friction of sliding bearings. Strength of different welder's umbrella supports. Stability of ladders with QuickClick. Stability and testing of box stacking. Valve failure due to water freezing. Stability of concrete boom extension. Bolt strength with different pre-stresses. Heat transfer and hypothermia due to cold seawater. Jet engine turbine blade subjected to thermal stresses. Fatigue life of Tin mill mandrel. Effect of chromium plating peeling on the throttle valve movement. Stresses near a nut embedded in a terminal base plate.

**1988-1997** Associate Research Engineer, Engineering College, U.C., Berkeley.  
**1986-1987** Assistant Professor, Shanghai Jiao Tong University, Shanghai, China  
**1984-1985** Research Associate, U. C. Berkeley Lawrence Laboratory.

**BOOKS:**

"Residual Stress Measurement and the Slitting Method", with Iain Finnie, 2007, Springer, ISBN 0-387-37065-X.

**OTHER PUBLICATIONS:**

46. "Control of Solar Steam Generators", with Peter Tanner and et al., POWER2011-55175, ASME, 2011.

45. "The Computation And Measurement Of Residual Stresses In Laser Deposited



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- Layers”, with S. Finnie and et al., *ASME J. of Eng. Mat. and Tech.*, **125**, 1-7 (2003).
44. Cheng, W. (2002) “A Summary Of Past Contributions In 24 Papers On Residual Stresses”, with I. Finnie, the Fourth International Conference on Residual Stresses, 2002, Portugal.
43. With I. Finnie and R. Ritchie, Residual Stress Measurement on a Pyrolytic Carbon-Coated Graphite Leaflet, (2001)
42. “Measurement of the Axial Residual Stresses Using the Initial Strain Approach,@ *ASME J. of Eng. Mat. and Tech.*, **122**, 135-140 (2000).
41. “Determination of the Mode I Stress Intensity Factors for an Edge-Cracked Beam with Fixed Ends,@ *Eng. Fracture Mech.* **63**, 193-208 (1999).
40. "Analytical and experimental evaluation of residual stresses in BWR core shroud welds", with R. Pathania and et al., ASME Pressure Vess. and Piping Division Pub., Vol. PVP 373, 1998, 337--349
39. With Finnie, I. (1998) “The Single-Slice Method for Measurement of Axisymmetric Residual Stresses in Solid Rods or Hollow Cylinders in the Region of Plane Strain,@ *ASME J. of Eng. Mat. and Tech.* **120**, 170-176.
38. “Experimental Determination of Stress Intensity Factors Due to Residual Stresses,@ with H. J. Schindler, et al., *Experimental Mechanics*, **37**, 272-277, 1997.
37. “Computation of Stress Intensity Factors for Three-Dimensional Bodies Using Crack-Displacements,@ with I. Finnie, *Int. J. of Fracture*, **83**, 91-104, 1997.
36. “Residual Stress Measurement by the Introduction of Slots or Cracks,@ with I. Finnie, “Localized Damage IV@, Eds. Nisitani et al. Computation Mechanics Publications, 37-51, 1996.
35. “Computation of Stress Intensity Factors for a 2-D body from Displacements at an Arbitrary Location,@ with I. Finnie, *Int. J. of Fracture*, **81**, 259-267,1996.
34. “Residual Stress Measurement by the Introduction of Slots or Cracks,@ with I. Finnie, *Proc. Int. Conf. On Localized Damage*, Fukuoha, Japan, June 1996.



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33. "Stress Analysis and Fatigue Life Prediction for a U-Bend Steam Generator tube,@ with I. Finnie, *Nuclear Engineering and Design*, **165**, 101-109, 1996.
32. "Analysis of the Fluid-Elastic Vibration of a U-Bend Tube Bundle Induced by Cross-Flow in PWR Steam Generators,@ with I. Finnie, *Nuclear Engineering and Design*, **160** pp. 111-128, 1996.
31. "Residual Stresses and Fracture Mechanics,@ with I. Finnie, *ASME J. of Eng. Mat. and Tech.* **117** pp. 373-378, 1995.
30. "An Overview of the Crack Compliance Method for Residual Stress Measurement," presented at the Fourth International Conference on Residual Stresses, with I. Finnie, Proceedings of the Fourth International Conference on Residual Stresses, Baltimore, pp. 449-458, 1994.
29. "Measurement of Residual Stress Distribution in a Disk or Solid Cylinder Using the Crack Compliance Technique," with H. J. Schindler, et al, Fourth International Conference on Residual Stresses, Baltimore, June, 1994.
28. "The Compliance Method for Measurement of Near Surface Residual Stresses - Application and Validation for Surface Treatment by Laser and Shot-Peening," with I. Finnie and et al, *ASME J. of Eng. Mat. and Tech.* **116**, pp. 556-560, 1994.
27. "The Compliance Method for Measurement of Near Surface Residual Stresses - Analytical Background," with M. Gremaud and et al in *ASME J. of Eng. Mat. and Tech.*, **116**, pp. 550-555, 1994.
26. "Measurement of Near Surface Residual Stress Using Electric Discharge Wire Machining," with M. Gremaud and et al, *ASME J. of Eng. Mat. and Tech.*, **116**, 1-7,1994.
25. "Measurement of Residual Stress Distributions Near the Toe of an Attachment Welded on a Plate Using the Crack Compliance Method ", with I. Finnie, *Eng. Fracture Mech.*, **46**, 79-92, 1993.
24. "A Comparison of the Strains due to Edge Cracks and Cuts of Finite Width With Applications to Residual Stress Measurement", with I. Finnie, *ASME J. of Eng. Mat. and Tech.*, **115**, 220-226, 1993.
23. "A Prediction of the Strength of Glass Following the Formation of Sub-Surface Flaws by Scribing," with I. Finnie, *Journal of Am. Ceramic Soc.*, **75**, pp. 2565-72 (1992).



22. "Measurement of Residual Stresses in Laser Treated Layers Using the Crack Compliance Method," with M. Gremaud, et al, *Proc. of Int. Conf. on Laser Advanced Materials Processing*, Edited by Matsunawa and Katayama, 713-718, 1992.
21. "Measurement of Residual Stress Distributions near the Toe of a Weld Between a Bracket and a Plate Using the Crack Compliance Method," with I. Finnie, *Proc. of IUTAM Symposium, Mechanical Effects of Welding*, Edited by L. Karisson, L. Lindgren and M. Jonsson, Springer-Verlag Berlin Heidelberg, 135-141, 1992.
20. "Deformation of an Edge-cracked Strip Subjected to Arbitrary Shear Surface Traction on the Crack Faces", with I. Finnie, *Eng. Fracture Mechanics*, **43**, pp. 33-40, 1992.
19. "Measurement of Residual Stresses Through the Thickness of a Strip Using the Crack-Compliance Method," with M. Prime, et al, *Residual Stresses - III Science and Technology Vol. 2*, Edited by H. Fujiwara, T. Abe and K. Tanaka, Elsevier Science Publishers, London and New York, pp. 1127-1132, 1992.
18. "Estimation of Axisymmetric Residual Stresses in a Long Cylinder," with I. Finnie, et al, *ASME J. of Eng. Mat. Tech.*, **114**, pp. 137-140, 1992.
17. "Deformation of an Edge-Cracked Strip Subjected to Normal Surface Traction on the Crack Faces," with Ö. Vardar, et al, *Eng. Fracture Mechanics*, **42**, pp. 97-108, 1992.
16. "An Experimental Method for Determining Residual Stresses in Welds," With I. Finnie, In *Modeling of Casting, Welding and Advanced Solidification Processes - V*, (M. Rappaz ed.), The Minerals Metals and Materials Soc. Warrendale, PA, USA (1991).
15. "Measurement of Residual Stresses Near the Surface Using the Crack Compliance Method," with Ö. Vardar, et al, *ASME J. of Eng. Mat. and Tech.*, **113**, pp. 199-204 (1990).
14. "Delayed Crack Propagation in a Steel Pressure Vessel Due to Thermal Stresses," with I. Finnie and K. J. McCorkindale, *Int. J. Pres. & Piping*, **42**, pp. 15-31 (1990).
13. "The Crack Compliance Method for Residual Stress Measurement," with I. Finnie, *Welding in the World*, **28**, pp. 103-110 (1990).
12. "Median Cracking of Brittle Solids due to Scribing With Sharp Indenters," with E. Ling, et al, *Journal of Am. Ceramic Soc.*, **73**, pp. 580-86 (1990).



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11. "K Solutions for an Edge-Cracked Strip," with I. Finnie, *Eng. Fracture Mechanics*, **36**, pp. 355-360 (1990).
  10. "A Mechanism for Subsurface Median Crack Initiation in Glass During Indenting and Scribing," with I. Finnie, *J. of Mat. Sci.*, **25**, pp. 575-579 (1990).
  9. "Stress Intensity Factors for Radial Cracks in Cylinders and Other Simply Closed Bodies," with I. Finnie, *Eng. Fracture Mechanics*, **32**, pp. 767-774 (1989).
  8. "K<sub>I</sub> Solution for an Edge-Cracked Strip," with I. Finnie, *Eng. Fracture Mechanics*, **31**, pp. 201-207 (1988).
  7. "A New Method for Measurement of Residual Axial Stresses Applied to a Multi-Pass Butt-Welded Cylinder," with I. Finnie, *ASME J. of Eng. Mat. and Tech.*, **109**, pp. 337-342 (1987).
  6. "Determination of Stress Intensity Factors for Partial Penetration Axial Cracks in Thin-Walled Cylinders," with I. Finnie, *ASME J. of Eng. Mat. and Tech.*, **108**, pp. 83-86 (1986).
  5. "Measurement of Residual Hoop Stresses in Cylinders Using the Compliance Method," with I. Finnie, *ASME J. of Eng. Mat. and Tech.*, **108**, pp. 87-92 (1986).
  4. "Examination of the Computational Model for the Layer-Removal Method for Residual-Stress Measurement," with I. Finnie, *SEM Experimental Mechanics*, **26**, pp. 150-152 (1986).
  3. "A Method for Measurement of Axisymmetric Residual Stresses in Circumferentially Welded Thin-Walled Cylinders," with I. Finnie, *ASME, J. of Eng. Mat. and Tech.*, **106**, pp. 181-185 (1985).
  2. "On the Prediction of Stress Intensity Factors for Axisymmetric Cracks in Thin-Walled Cylinders From Plane Strain Solutions," with I. Finnie, *ASME J. of Eng. Mat. and Tech.*, **106**, pp. 227-231 (1985).
  1. "Prediction of the Stress Intensity Factor for an Internal Circumferential Crack at a Butt-Weld Between Cylinders Using Plane Strain Solutions," with G. Stevick, et al, *ASME J. of Eng. Mat. and Tech.*, **106**, pp. 21-24 (1984).