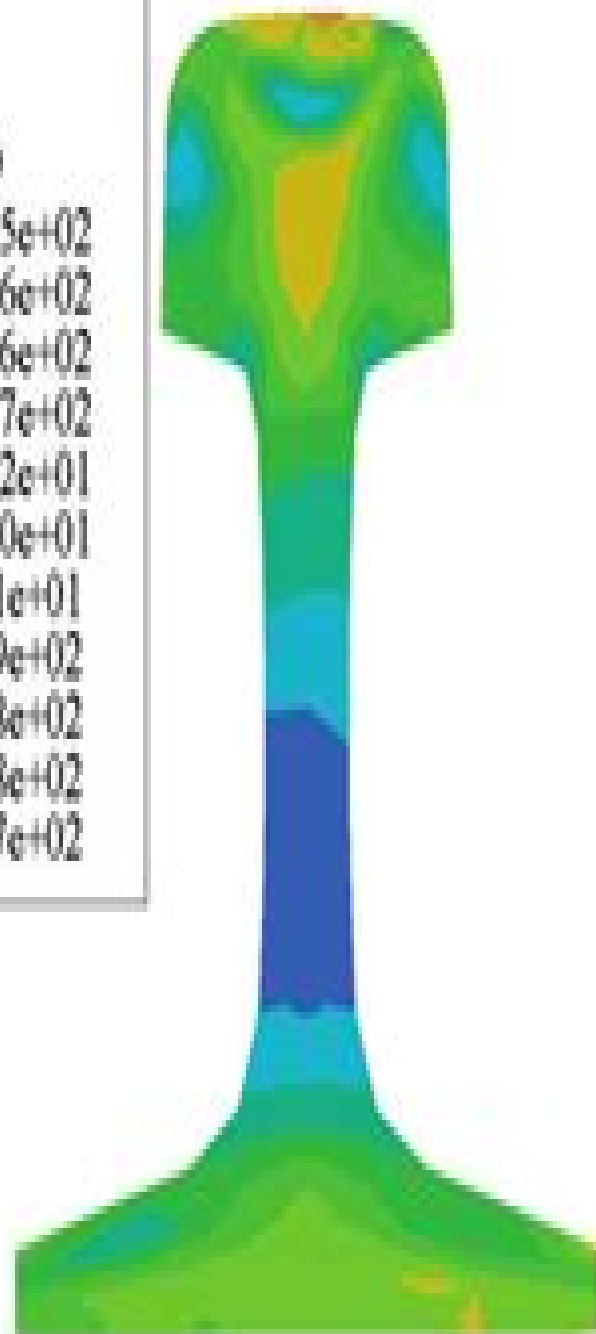
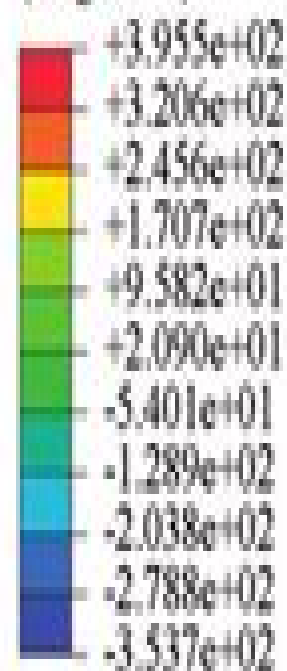


(a)

S, S33

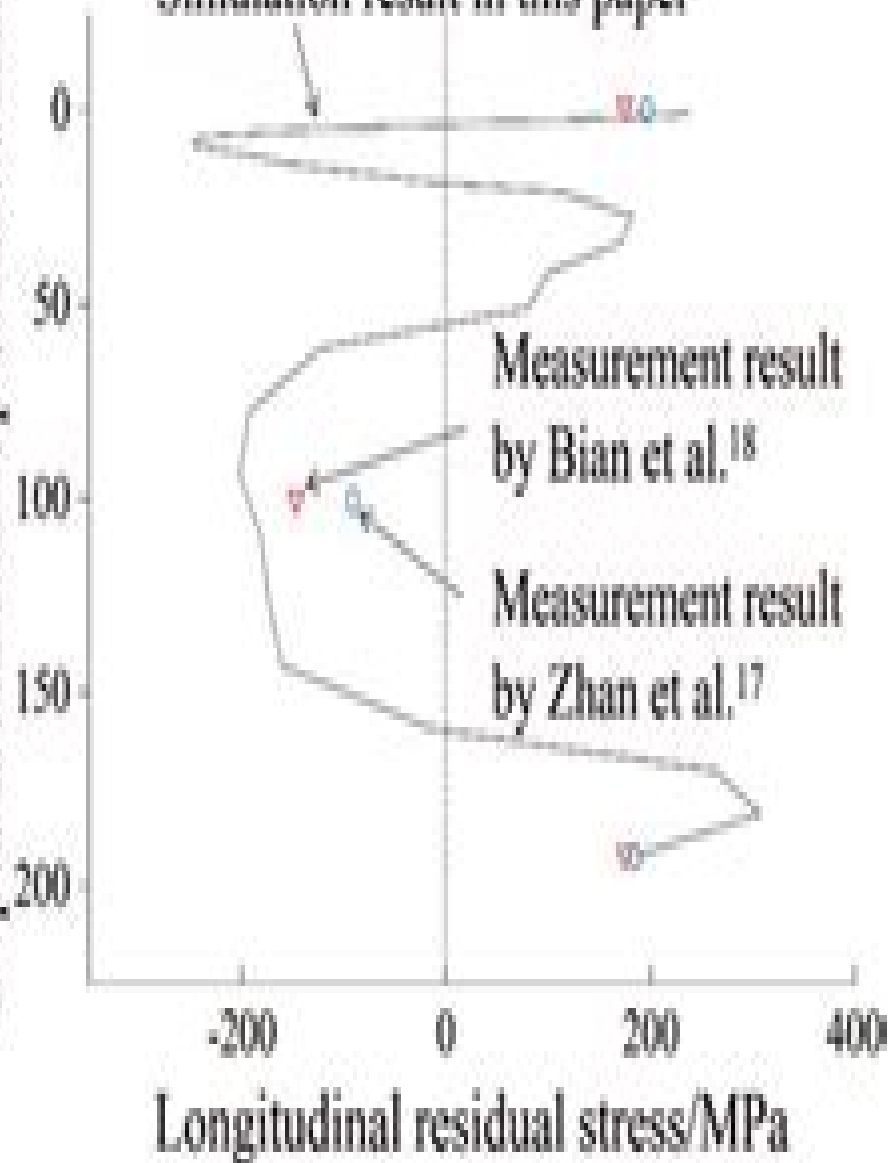
(Avg: 75%)



(b)

Depth from rail top surface/mm

Simulation result in this paper



# Residual Stress In Rails

**Rachel S Tattersall**



## **Residual Stress In Rails:**

**Residual Stress in Rails** O. Orringer, J. Orkisz, Zdzisław Swiderski, 1992-03-31 Rail integrity is a current application of engineering fracture mechanics at a practical level. Although railroad rails have been manufactured and used for more than a century, it is only in the last ten years that the effects of their crack propagation and fracture characteristics have been considered from a rational viewpoint. The practical objectives are to develop damage tolerance criteria for rail inspection and to improve the fracture resistance of new rail production. Rail fatigue crack propagation rates and fracture resistance are strongly influenced by residual stresses which are introduced into the rail both during production and in service. Therefore the rail residual stress field must be well understood before fracture mechanics can be usefully applied to the subject of rail integrity. The three-dimensional character of rail and its stress fields make it essential to apply both experimental and analytical methods in order to understand the effects of production and service variables on residual stress and the effects of the stress on fatigue crack propagation and fracture. This volume brings together field observations and experimental stress analysis of railroad rails in the United States and Europe. The ongoing search for an efficient and accurate technique is emphasized. A companion volume brings together several analytical investigations based on advanced computational mechanics methods for correlation of the experimental data as well as evaluation of the effects of residual stress on rail integrity.

**Residual stress in rails :** Oscar Orringer, Janusz Orkisz, Zdzisław Świdorski, 1992-03-15 These volumes contain contributions from a conference on the themes of measurement and prediction of residual stress in railroad rails. The first volume features practical railway experience and laboratory tests while the second one presents theoretical and numerical analyses.

**Residual Stress in Rails** Oscar Orringer, Janusz Orkisz, Zdzisław Świdorski, 1992 *Residual Stress in Rails*, 1992 *Residual Stress in Rails* O. Orringer, J. Orkisz, Zdzisław Swiderski, 1992-03-31 Rail integrity is a current application of engineering fracture mechanics at a practical level. Although railroad rails have been manufactured and used for more than a century, it is only in the last ten years that the effects of their crack propagation and fracture characteristics have been considered from a rational viewpoint. The practical objectives are to develop damage tolerance criteria for rail inspection and to improve the fracture resistance of new rail production. Rail fatigue crack propagation rates and fracture resistance are strongly influenced by residual stresses which are introduced into the rail both during production and in service. Therefore the rail residual stress field must be well understood before fracture mechanics can be usefully applied to the subject of rail integrity. The three-dimensional character of rail and its stress fields make it essential to apply both experimental and analytical methods in order to understand the effects of production and service variables on residual stress and the effects of the stress on fatigue crack propagation and fracture. This volume brings together field observations and experimental stress analysis of railroad rails in the United States and Europe. The ongoing search for an efficient and accurate technique is emphasized. A companion volume brings together several analytical investigations based on advanced computational

mechanics methods for correlation of the experimental data as well as evaluation of the effects of residual stress on rail integrity

**Handbook of Residual Stress and Deformation of Steel** George E. Totten, 2002 Annotation Examines the factors that contribute to overall steel deformation problems The 27 articles address the effect of materials and processing the measurement and prediction of residual stress and distortion and residual stress formation in the shaping of materials during hardening processes and during manufacturing processes Some of the topics are the stability and relaxation behavior of macro and micro residual stresses stress determination in coatings the effects of process equipment design the application of metal thermo mechanic to quenching inducing compressive stresses through controlled shot peening and the origin and assessment of residual stresses during welding and brazing Annotation c Book News Inc Portland OR booknews com

**Residual stress in railway rails** Joseph Francis Kelleher, University of Manchester. School of Materials, 2006

**Residual Stress Measurement in Railroad Rails** B. W. Maxfield, T. Edward Whittick, A. Kuramoto, 1990 Description of the implementation of an acoustic shear wave birefringence method for measuring the difference in the in plane residual stresses for the two orthogonal polarization directions Specimens 40 mm thick were cut from the head of head hardened and as rolled rail sections A permanent magnet EMAT ultrasonic system was used to measure the difference in the transit time for the two shear polarizations to an accuracy of positive negative 2 ns which corresponds to a stress error of about positive negative 20 20 MPa The transit difference was measured as a function of position over the cross section of the rail head with a spatial resolution of about 10 mm

**Residual Stress Measurement in Railroad Rails. Phase I** B. W.

Maxfield, Transportation Development Centre (Canada), Permatrack Systems Inc, 1991

*Rail Quality and Maintenance for Modern Railway Operation* J.J. Kalker, D.F. Cannon, O. Orringer, 2013-04-18 In April 1990 a conference was held at the Cracow Institute of Technology Cracow Poland The title of that conference was Residual Stresses in Rails Effects on Rail Integrity and Railroad Economics and its themes were the measurement and prediction of residual stresses in rails but as the sub title suggests the intention was also to provide a link between research and its application to the practical railway world At the Cracow conference there were 40 participants with 5 railways and 5 rail makers being represented and 25 papers were given The Cracow conference was a success and by March 1991 its off spring The International Conference on Rail Quality and Maintenance for Modern Railway Operations was conceived and birth was ultimately given in June 1992 at the Technical University Delft It turned out to be some baby with 112 delegates from 24 countries taking part As with its predecessor the conference was to provide a forum for the exchange of ideas between research investigators rail makers and railway engineers A cursory examination of the list of participants suggests that about 57% were from the railway industry 34% from universities and other research institutions and 9% from the steel industry Bearing in mind that some of the railway industry participants were from their respective research and development organisations the balance of interests was about right

**International Conference on Residual Stresses** G. Beck, S. Denis, A. Simon, 2012-12-06 Residual stresses

are always introduced in materials when they are produced or when they undergo non uniform plastic deformation during use. The circumstances that can cause residual stresses are therefore numerous. Residual stresses exist in all materials and depending on their distribution can play a beneficial role for example compressive surface stress or have a catastrophic effect especially on fatigue behaviour and corrosion properties. The subject of residual stresses took form around 1970 with the development of methods to measure macroscopic deformations during the machining of materials or on an atomic scale by X ray diffraction. These techniques have made considerable progress in the last 20 years. The meetings organized in several countries Germany France Japan etc have largely contributed to this progress aided by the numerous exchanges of information and knowledge to which they have given rise. Studies of the formation of residual stresses began more slowly but have progressed with the emergence of increasingly realistic models of materials behaviour and with access to ever more powerful codes for numerical calculations. Two successive meetings for discussing this topic have been held in Europe. The first held in 1982 in Nancy France consisted of 30 participants from 5 countries. The second was held in Linköping Sweden in 1984 with 80 participants of 16 nationalities. It was decided to hold a first International Conference ICRS to address all aspects of the problem. Held in 1986 in Garmisch Partenkirchen FRG it was an assembly of nearly 300 participants from 21 countries.

Residual Stress Formation During the Roller Straightening of Rails Gerald Schleiner, 2000

Residual Stress Measurement Jude Odihachukwuma Igwemezie, Transportation Development Centre (Canada), Canadian Institute of Guided Ground Transport, 1994

**Failure Analysis in Engineering Applications** Shin-Ichi Nishida, 2014-05-15

Failure Analysis in Engineering Applications deals with equipment and machine design together with examples of failures and countermeasures to avoid such failures. This book analyzes failures in facilities or structures and the ways to prevent them from happening in the future. The author describes conventional terms associated with failure or states of failure including the strength of materials as well as the procedure in failure analysis materials used design stress service conditions simulation examination of results. The author also describes the mechanism of fatigue failure and prediction methods to estimate the remaining life of affected structures. The author cites some precautions to be followed in actual failure analysis such as detailed observation on the fracture site removal of surface deposits for example rusts without altering the fracture size or shape. The book gives examples of analysis of failure involving a crane head sheave hanger wire rope transmission shaft environmental failure of fastening screws and failures in rail joints. This book is intended for civil and industrial engineers for technical designers or engineers involved in the maintenance of equipment machineries and structures.

Experimental 3-D Residual Stress Measurements in Rails with Thermal Annealing , 1999

**International Scientific Conference Energy Management of Municipal Facilities and Sustainable Energy Technologies EMMFT 2018** Vera Murgul, Marco Pasetti, 2019-05-27

This book presents a collection of the latest studies on and applications for the sustainable development of urban energy systems. Based on the 20th International Scientific Conference on Energy Management of

Municipal Facilities and Sustainable Energy Technologies held in Voronezh and Samara Russia from 10 to 13 December 2018 it addresses a range of aspects including energy modelling materials and applications in buildings heating ventilation and air conditioning systems renewable energy technologies photovoltaic biomass and wind energy electrical energy storage energy management and life cycle assessment in urban systems and transportation The book is intended for a broad readership from policymakers tasked with evaluating and promoting key enabling technologies efficiency policies and sustainable energy practices to researchers and engineers involved in the design and analysis of complex systems

**Microstructure and Residual Stress State in the Contact Zone of Rails and Wheels**, 2002 Optical Methods in Experimental Solid

Mechanics Karl-Hans Laermann, 2014-05-04 The book covers the theories and physics of advanced new optical measuring methods and problems of experimental performance recent achievements in the basic interferometric methods holography speckle interferometry shearography as well as linear non linear photoelasticity and photoviscoelasticity Moir and grid techniques It deals with theory and application of digital image processing methods of data recording data processing and visualisation with mathematical numerical procedures for final evaluation of digitised measured data and the principle of hybrid techniques It introduces into the new perceptions of methods in experimental solid mechanics and it should encourage scientists to deal intensively with the theories for further developments and enables practitioners to understand theory and physics of the new achievements at least and to apply the methods in research as well as in developments in practice

**26th Symposium on Experimental Mechanics of Solids** Paweł Pyrzanowski, Jacek Gądomski, 2015-08-28 Selected peer reviewed papers from the 26th Symposium on Experimental Mechanics of Solids October 22-25 2014

Jachranka Poland **A Proposed Method on the Determination of Residual Stresses in Rails** Terence Hon-wing Cheung, 1976

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