MSE SEMINAR

October 6, 2017
113 McBryde Hall
3:30 – 4:30 PM
Refreshments at 3:00 PM

Professor Milo Kral

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"Assessing the plastic strain and residual strain capacity of earthquake damaged steel reinforcing bars"

Abstract

Modern seismic codes for buildings are based on capacity design and hierarchy of strength philosophy that allows inelastic response in case of severe earthquakes. Thus, in most traditional systems, earthquake damage develops at well-defined locations of reinforced concrete structures. "Plastic hinges" form in structural elements such as beams, coupling beams and at the base of columns and walls. As a result, plastic strain develops in individual reinforcement bars, which could affect a building's capacity to resist future earthquake activity. Thus, there is a strong demand from government, industry and society in general to develop techniques for assessing damage to steel reinforcement bars embedded in cracked structural concrete elements of earthquake-damaged buildings. Although some earlier studies attempted to achieve this, a validated methodology to quantify the level and extent of plastic deformation and residual strain capacity has still not yet been widely accepted. In this paper, a robust damage assessment methodology is proposed, based on empirical relationships between Vickers hardness versus plastic strain and residual strain capacity, also accounting for the effects of strain ageing. The method has been applied to several buildings damaged in the 2010/2011 sequence of earthquakes in Christchurch New Zealand, and more recently in the 2016 Kaikoura event that affected buildings in Wellington NZ.

Biosketch

Milo Kral received his B.E. in Mechanical Engineering from Vanderbilt University in Nashville TN (1984) and then worked at the Rochester Products Division of General Motors in Rochester NY for the following 6 years. He then returned to Vanderbilt for his M.S. (1992) and Ph.D. (1996) in Materials Science and Engineering. Milo was awarded an ASEE postdoctoral fellowship and subsequently worked for two years in the Physical Metallurgy Branch at the US Naval Research Laboratory in Washington DC. In 1998, he was appointed to the faculty of engineering University of Canterbury, Christchurch New Zealand, was Head of Mechanical Engineering 2007-2017 and attained the rank of Professor in 2011.

Prof. Kral has written or co-authored over 50 refereed international journal publications and conference articles. He has written 4 book chapters, including chapters in Volume 9 and 22B of the prestigious ASM Metals Handbook series. He has successfully mentored 15 Ph.D. and M.E. students and has managed research grants of over $3M from both government sources and private companies.