

About the Speaker

Deric Oehlers is Professor of Structural Engineering at the School of Civil, Environmental and Mining Engineering at The University of Adelaide, Australia. He holds a Bachelor degree in Civil Engineering from London University and a Masters and PhD from Warwick University, UK, and was awarded a Doctor of Engineering from Adelaide University, Australia, for his research into the partial-interaction behaviour of both composite steel and concrete structures and FRP reinforced and retrofitted concrete structures. He has published 133 journal papers (1032 citations) and 4 books (276 citations) which includes the Australian retrofitting guideline “Design Guideline for RC structures retrofitted with FRP and metal plates - Standards Australia HB 305”.

Seminar

Title: A new mechanics approach for reinforced concrete – why the current empirical approach has severely held back the development of reinforced concrete.

Synopsis:

Ductile steel reinforced concrete structural members are very simple mechanisms. The concrete takes compression, ductile steel reinforcing bars resist tension and design rules are developed for shear, flexure and axial loads. The driving mechanics in developing these design rules is the Euler-Bernoulli fundamental principle of plane sections remaining plane. However and unfortunately, the ductile steel reinforced concrete research community has dogmatically adhered to the Euler-Bernoulli corollary of a linear strain profile that is the moment-curvature approach. And consequently full-interaction, that is there is no slip between the reinforcement and the concrete such that the bond-slip properties are of no consequence.

It will be shown in this presentation that the use by the ductile steel reinforced concrete research community of a moment-curvature approach for all aspects of reinforced concrete has forced the development of empirical design rules. The consequence of which are that they can only be applied within the bounds of the testing regimes from which they were developed and are, therefore, of virtually no use for reinforced concrete members that do not have ductile steel reinforcement or for member sizes that fall outside the bounds of the original testing regimes. It is suggested that this approach has held back the development of reinforced concrete by making it incredibly difficult and expensive to bring in new technologies.

A new moment-rotation model is described that is based on the Euler-Bernoulli principle of plane sections remaining plane and not on the corollary of a linear strain profile. It will be shown that this moment-rotation approach gives the same results as the moment-curvature approach prior to concrete cracking and concrete softening. After which, the moment-rotation approach uses the mechanics of both partial-interaction and shear-friction to allow for cracking and softening as opposed to empirical approaches that dominate the moment-curvature approach. It will be shown that it is very easy to incorporate into the moment-rotation approach through mechanics such effects as confinement, creep, shrinkage, fibre concrete, any type of reinforcement, prestress and shear failure.