International Doctorate in Civil and Environmental Engineering

Luciano Rosati

University of Naples Federico II

Recent Phenomenological Models of Rate-Independent Hysteresis

The number and nature of hysteretic responses typically exhibited by mechanical systems and materials are so huge that their modeling and identification are usually carried out on an ad-hoc basis. With the aim of proposing a unified approach to the modeling of rate-independent hysteretic behavior, we formulate a novel rate-independent hysteretic model, having an exponential nature, that offers a series of advantages over other hysteretic models available in the literature. The adopted closed form expressions enable important benefits in terms of computational efficiency and implementation ease. The accuracy of the proposed model is experimentally and numerically validated, and its computational efficiency is demonstrated. The experimental validation is carried out by reproducing four different types of complex experimental hysteresis loops retrieved from the literature, whereas the numerical validation is performed by running some nonlinear analyses on a single degree of freedom mechanical system and comparing the results with those obtained by using a modified version of the celebrated Graesser–Cozzarelli model.

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Aula Pacinotti

Scuola di Ingegneria, Università di Pisa – Largo Lazzarino, 56122 Pisa

For any information: riccardo.barsotti@unipi.it, bennati.stefano@gmail.com