11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20 - 25, 2014, Barcelona, Spain

Effect of interfacial strength on the response of sandwich plates with elastomeric cores

Alireza V. Amirkhizi[1] and Zhanzhan Jia[2]

[1] University of Massachusetts, Lowell, Perry Hall P-332, One University Ave. Lowell, MA 01854, alireza_amirkhizi@uml.edu
[2] University of California, San Diego, EBU-I 4200, 9500 Gilman Dr. La Jolla, CA 92093, z1jia@ucsd.edu

Key Words: *Interfacial Strength, Sandwich Plates, Elastomeric Materials.*

The use of elastomers and their composites as well as layered and sandwich structures based on these materials has become an interesting research subject in the recent years. One driving factor for such interest has been the surprising improvement observed in the blast resistance of metal/polyurea (PU) bilayers. The interfacial strength of metal polyurea bond has been shown to be very high, yet the quantification of the strength and energy of debonding has not been addressed thoroughly. Furthermore, PU based particulate composites, especially with glass inclusions, have been proven to show improved dynamic stiffness and dissipation. Previous methods based on fiber pull out analysis have given preliminary data on the bonding strength when surface treatment allows for covalent bonding between the resin and inclusion. However, this method does not give precise results for the the low strength range (e.g. Van der Waals or hydrogen bonding). Furthermore, it is not straightforward to extract the energy of debonding from these experiments. With that in mind, we propose a computational experiment design to identify configurations that allow for extraction of these parameters, particularly for low-strength bonds. To do this, we propose use of sandwich plates of glass slides bonded by a very thin layer of elastomer. The constitutive model of the elastomer and glass is assumed well understood, yet the interfacial strength is an unknown parameter. By fine-tuning the geometry of the test (thickness of glass and elastomer layers, length, width, etc.) and the loading conditions (e.g. quasi-static or dynamic), we look for a configuration in which the response of the sandwich plate is particularly sensitive to the interfacial strength in the expected range, understanding that this problem may not have a physically feasible solution. It is expected that once the computational program leads to an ideal geometry, experimental work follows for extraction the interfacial strength and energy.