Effect of the coating properties on the deformation and wave distribution in the leading edge erosion system

The model is an expanded and modified version of the model by V. Fedorov, see for instance [1]. The material under droplet was designed as multilayered materials, with two layer protective coating, gelcoat, and filler, all on the top of laminate. The model is designed in such a way that it can be easily expanded to simulate the interlayer debonding, coating/gelcoat, gelcoat/filler, and filler/laminate debonding. It is realized by creating “interphase/interface” layers between the coatings, following the concept of 3D interfaces by Povl Brøndstedt and Leon Mishnaevsky Jr [2]. In this way, the model can be used for optimization of protective coatings and their structures, testing various parameters of the protective systems and development of recommendations to their improvement. In order to demonstrate the application of the model for the analysis, we used the model to study various coating structures, and compare two extreme cases, namely, stiff upper coating/soft lower coating and, inversely, soft upper coating/stiff lower coating placed on homogeneous gelcoat, filler and laminate. The properties of gelcoat, filler and laminate remained the same in all cases, however, the stiff and soft phases have had drastically changed properties. The developed computational model allows numerical testing of various protective systems. The models is expandable and allows also to add specific damage mechanisms, as well as more complex (plastic, viscous, damping) behavior of protective layers. Further, more detailed models of filler and gelcoat should be added. Varying the stiffness and amount of protective layers, one can control the damage initiation and growth if composites.

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