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A STUDY ON AMPLITUDE TRANSMISSION IN ULTRASONIC WELDING OF THERMOPLASTIC COMPOSITES

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Abstract

Ultrasonic welding of thermoplastic composite materials is a promising joining technique that is now moving towards up-scaling, i.e. the assembling of large industrial parts. Despite its growing technological maturation, the assumed physical mechanisms underlying ultrasonic heating (viscoelastic heating, friction) are still insufficiently understood and modelled. In particular, the hammering phenomenon, resulting from the periodic loss of contact between the sonotrode and adherends due to the high frequency vibration caused to the former, directly impacts the heating efficiency. We propose in this work an original experimental and modelling approach towards a better understanding of the hammering effect. This approach makes combined use of: (i) an experimental static welding setup provided with a high-frequency laser sensor to analyse the vibration amplitude transmitted to the adherends and (ii) an improvement of the multiphysical finite element model already presented in previous works. Results show it is possible to obtain a good estimation of the vibration transmitted to the upper adherend from laser measurements close to the sonotrode. The hammering effect is shown to decrease during the welding process, due to the heating of the interface which directly affects further