Passive control of vibrations and noise in carbon composite vehicles

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Computer-Aided Engineering(CAE) are increasingly used in the automotive industry to predict the acoustic behavior of cars and adapt the design based on the outcome of simulations. This reduces the need for expensive physical prototypes. The goal of this study is to enhance the acoustic of cars by studying the vibrational energy flow in the vehicle structure and the sound power and intensity levels in the driver's ear position taking into account the effect of material damping and its dependence on frequency. To achieve this goal, a new post-processing tool to calculate the vibrational energy flow in the full vehicle body is implemented. This tool is able to analyze quickly very large models. The in-plane and out of plane parts of the vibrational energy flow are implemented. The damping of the complete vehicle is calculated by the modal strain energy method. The sound power and intensity levels are calculated in the position of the driver's ear in the fluid inside the vehicle which is coupled with the structure. With these tools, the effect of damping patches types and positions, the effect of material properties and the effect of changing the design on the passive control of noise and vibrations in vehicles are studied.The benefit of this research for acoustics is that it demonstrates the importance of passive control methods to obtain premium acoustic behavior of vehicles. Consequently, vibrational energy propagated in carbon composite structures will be reduced, and lower radiated noise will be achieved.