



Windshield wiper evaluations for High Speed wipe Quality (HSQ) and Water Pullback (WPB) performance using OpenFOAM

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The numerical simulation of wiper motion is necessary to understand and optimize the designs for High Speed wipe Quality (HSQ) and Water Pullback (WPB) performance to ensure safety while driving. WPB is due the adverse pressure gradients near wiper, whereas the HSQ is due to the aerodynamic lift forces on wiper components at high vehicle speeds. This is undesirable because of safety concerns. Consequently, facilitating the wiper motion on the windshield and the study of such phenomena is a paramount interest. However, due to the windshield curvature, it is a challenge to perform wiper motion just by using primary mesh motion functions. It creates mesh interferences (penetration of wiper inside windshield surface) during the wiper motion. In this paper, the fundamentals of wiper motion in terms of mesh morphing with vector projection along with translation is outlined and a motion constraint utility is developed in OpenFOAM. For this particular case, the wiper performs oscillating and rotating motion with additional constraints, the utility is integrated with the moveDynamicMesh application. The constraint utility is coded in C++ and the validation is performed on OpenFOAM v1712. The differences obtained with and without the utility for carrying out the wiper motion and is presented. The constraint utility provides an advantage of keeping the wiper always over the windshield and preventing any mesh interferences. It is an addition to the open source development and will be helpful in performing the simulations for studying the WPB & HSQ phenomena in OpenFOAM.