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Computational Physics in the Automotive Industry

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Computational physics is an ever-present, though admittedly behind-the-scenes, force in aiding a vast variety of companies advance their technologies and products. The escalating cost of traditional development paths, which rely heavily on experimental testing, as well as the ever-increasing urgency in being the first to market, have further increased reliance on computational methods. In particular, the automotive industry is developing a wide range of computational methods to accelerate development of novel materials, for lightweighting vehicles, high-temperature engine components and battery applications. These computational techniques encompass first-principles, atomistic simulations of material phases, micron-scale phase-field modeling of phase evolution, microstructure-based process simulation, and ultimately prediction of the material performance in macroscopic and component-size systems. A few of these applications and the role of computational physics will be briefly presented.