

TRANSIENT NUMERICAL ASSESSMENT OF RACE CAR DRY-SUMP OIL UNDER DIFFERENT MANEUVERS

Santiago F. Corzo^a, Norberto M. Nigro^a, Jose Risso^a and Damián E. Ramajo^a

^a*Centro de Investigación de Métodos Computacionales (CIMEC-CONICET) Predio CONICET Santa Fe "Dr. Alberto Cassano", Colectora Ruta Nac Nro 168, Km 0, Paraje El Pozo, 3000 Santa Fe.*

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Abstract. A numerical assessment of a dry-sump oil system was performed by Computational Fluid Dynamics (CFD). Unlike conventional cars, race cars are subjected to high accelerations that induce oil sloshing. Hence, dry-sump oil systems are required to collect the oil outside of the engine prior to be pumped inside of it again. To avoid engine malfunctions, the dry-sump must guarantee continuously oil suction in every maneuver. To perform such simulations, the model was subjected to different car maneuvers extracted from data acquisition available from real race car, showing that single and combined maneuvers, such as acceleration, braking and turnings can induce downward, upward and lateral accelerations higher than 2g during several seconds. Therefore, four different single maneuvers (acceleration, deceleration, turn right and turn left) as well as a set of contaminated maneuvers (braking and turning) were studied. Simulations were achieved by mean of the Volume of Fluid Method (VOF) for a air-oil system. The influence of the turbulence modeling was also investigated. First a forerunner design was analyzed and both the race car tests and CFD simulations showed that for the most extreme maneuvers (pure braking and combined with braking with turning right) the original design failed before the end of the maneuvers by air suction in the pump inlet. In consequence, the dry-sump was redesigned and assessed under these extreme conditions until to ensure stable oil aspiration.