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POSSIBILITIES FOR USE OF SIMULATION MODELS IN RESEARCH OF ANGULAR SPEED VARIATIONS OF IC ENGINE'S CRANK SHAFT

ABSTRACT: Angular speed of a crank shaft is one of the output parameters of IC engine, based on which, important information on operating cycle, efficiency indicators and the state of the engine may be obtained. Periodical variations in pressure flow during a cycle and in inertial effects of a piston mechanism's moving parts dictate the angular speed variations even in stationary operating regimes. By acquiring and processing of such angular speed signal, it is possible to determine the following quantities: degree of irregularity of rotation of the crank shaft and flywheel mass, pressure flow in the engine cylinder during the cycle, engine power and torque, position of the centre of combustion law, absence of ignition and other diagnostics parameters. Advantage of the use of this method may be seen in the fact that simpler measuring devices and measurement procedures are used for acquisition of angular speed variations than the measuring devices used for measurement of given quantities (pressure and torque sensors, test benches with brakes and similar).

Simulation models are often used beside experimental methods for research of angular speed variations. In this paper, possibilities of application of such models are analyzed with special emphasis given to procedures of their calibration and verification of output results. The results presented in the paper are obtained based on the use of experimental results acquired on the test bench and the simulation model of a mono-cylinder test engine.

KEYWORDS: simulation model, angular speed variations, IC engine

INTRODUCTION

Angular speed of IC engine's crank shaft is a complex output quantity which nature of variation depends on pressure flow in the engine's cylinder during the cycle, kinematic and dynamic quantities of moving parts of the engine and its auxiliary devices, as well as on the nature of engine load variations due to operating machine. Periodical variations of pressure in the engine's cylinder, inertial effects of engine moving parts and operating machine loads induce the angular speed variations even in stationary regimes of engine operation. In this case, angular speed variations occur during engine cycle and are characterized by constant mean value. It is well known that, by analysis and processing of these variations, important output parameters of the engine may be determined (pressure variation in the cylinder, effective power, etc.).

Research of angular speed variations has been present in the literature from this field from the very beginnings of the IC engines. The reason is, by all means, their negative influence on engine's process development, as well as

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