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Opposed Piston Engine Crankshaft Strength Calculation Using Finite Element Method

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Abstract : The paper presents the results of the crankshaft strength simulation. The crankshaft was taken from the opposed piston engine. Calculations were made using finite element method (FEM) in Abaqus software. This program allows to perform strength tests of individual machine parts as well as their assemblies. The crankshaft that was used in the calculations will be used in the two-stroke aviation research aircraft engine. The assumptions for the calculations were obtained from the AVL Boost software, from one-dimensional engine cycle model and from the multibody model using the method developed in the MSC Adams software. The research engine will be equipped with 3 combustion chambers and two crankshafts. In order to shorten the calculation time, only one crankcase analysis was performed. The cut of the shaft has been selected with the greatest forces resulting from the engine operation. Calculations were made for two cases. For maximum piston force when maximum bending load occurs and for the maximum torque. Cast iron material was adopted. For this material, Poisson's number, density, and Young's modulus were determined. The computational grid contained of 1,977,473 Tet elements. This type of elements was chosen because of the complex design of the crankshaft. Results are presented in the form of stress distributions maps and displacements on the surface and inside the geometry of the shaft. The results show the places of tension stresses, however, no stresses are exceeded at any place. The shaft can thus be applied to the engine in its present form. Acknowledgement: This work has been realized in the cooperation with The Construction Office of WSK 'PZL-KALISZ' S.A. and is part of Grant Agreement No. POIR.01.02.00-00-0002/15 financed by the Polish National Centre for Research and Development.

Keywords : aircraft diesel engine, crankshaft, finite element method, two-stroke engine

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