

STUDY ON DIAGNOSTIC INDICATORS OF GEAR TOOTH CRACK LENGTH AND LOCATION IN A VIRTUAL GEAR TRANSMISSION

C. Carmignani, P.Forte, G.Melani

Dipartimento di Ingegneria Meccanica, Nucleare e della Produzione – University of Pisa

Via Diotisalvi 2 – 56126 Pisa, Italy

Phone: +39 050 836 646/636/684 Fax: +39 050 836665

e-mail: carmi@ing.unipi.it, p.forte@ing.unipi.it, gabriele.melani@ing.unipi.it

ABSTRACT

A numerical simulation of the dynamic behaviour of a system is surely a convenient means to perform preliminary testing of a diagnostic system, to support the interpretation of experimental results and to investigate on a wider range of operating conditions and defects.

In this work the dynamic behaviour of a faulted gear transmission was simulated. The gear overall stiffness was evaluated statically as function of the gear angular position by means of FE models of the mating wheels and of the supporting structure, taking into account the deformation of the teeth under load, the actual tooth shape, and the presence of faults such as tooth cracks of different lengths and at different locations on the tooth flank.

The so calculated meshing stiffness was employed to simulate the different dynamic behaviours of the cracked gears by means of a simplified lumped parameter model of the gear transmission (4 d.o.f.) in steady state conditions. The numerical simulation tests were carried out in a Simulink environment, for different applied torques and gear angular velocities. Subsequently, the simulated synchronously averaged acceleration signals produced by the virtual bench were processed by means of Matlab procedures and some standard and non standard diagnostic indicators were calculated in order to determine the most effective parameter (or combination of parameters) for the identification of the different crack configurations.

Keywords: diagnostics, simulation, gears, cracked tooth