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Sawalhi, N., Randall, R.B.

Gear parameter identification in a wind turbine gearbox using vibration signals
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Abstract
When carrying out vibration-based diagnosis of gearboxes it is desirable to know the numbers of teeth on all gears, so as to be able to calculate toothmesh frequencies and rotational speeds of all shafts. If the speed varies, this information must be obtained in the form of "shaft orders" related to the input and/or output speed. This paper describes how it was possible to extract most of this information from the vibration signal itself in the case of a wind turbine gearbox with one planetary and two helical parallel stages. Using a spectrogram, a section of signal was first found with minimal speed variation (about 4%) after which the instantaneous speed information was extracted by frequency demodulation of dominant speed related components. After order tracking based on this it was found possible to determine the numbers of teeth in the two parallel stages, using very accurate harmonic cursors applied to each of the shafts of pairs of gears in mesh (with common mesh frequency). This was successful for the two parallel stages, but the proposed estimates of the tooth numbers in the planetary section are subject to some doubt. Allowable combinations are quite restricted using the normally applied rules, but there can be exceptions. Even so, the presented approach is confirmed as a viable method.

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