**A Brief History of Coupling and Nonlinearity in the Vibration of Rotating Machines (1965-2015)**

by

**David Ewins**

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**ABSTRACT**

This lecture presents a high-level overview of 50 years evolution of vibration phenomena in high-performance Rotating Machinery and will focus on philosophical and strategic aspects more than highly-detailed technical tactics. From the very beginning, the vibration characteristics were studied both theoretically and experimentally, component by component and then assembled or ‘coupled’ to configure the final machine in service. In the earlier days, greater reliance had to be placed on the experimental procedures because mathematical models as we know then today simply did not exist and so much was learned about the physics of machinery dynamics by working with the real hardware, rather than idealised models of it. As a result of this approach, the real-world issues of damping, of rotational degrees of freedom and the inevitable occurrence of nonlinear behaviour were all encountered much earlier than would normally be the case in a more analytical approach where one starts by assuming these complexities do no (yet) exist. The talk will be based on many years’ experience with high-performance turbomachinery and will use specific examples to illustrate various phenomena related to coupling and nonlinearities on: bladed disc assemblies; friction blade dampers; whole engine casings; rotor-stator rubs and other interactions; magnetic bearings; rotor internal damping; apparently impossible measurements on unstable and nonlinear rotating components.

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