SEMINARIO DE ANÁLISIS NUMÉRICO Y MODELACIÓN MATEMÁTICA

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Título de la Charla:

Signal processing and modeling of mechanical systems in the context of machine failure diagnosis

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Lugar:

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Resumen

The concept of failure diagnosis can be explained as the task of inferring the functioning condition of a machine based on the measurement of the appropriate variables and its processing and analysis. Failure diagnosis involves a number of activities of different nature, such as electronics and signal processing, which are combined with knowledge about the dynamics of different mechanical systems and their effect on the behaviour of different variables. Due to its close relation with the forces acting inside a machine, vibrations and acoustic emissions are valuable variables for failure diagnosis purposes. This is because forces, in turn, relate with the condition of the machine; simply stated: forces have different characteristics depending on the condition of the machine (good or defective.) Mathematical modeling of mechanical systems has been largely used to study their behaviour under different faulty conditions. Based on physical laws, these models aim to describe the system of interest as close as reality as possible. However, sometimes the physical processes involved in the system can be so complex, that no reliable model can be developed. In this case, assumptions or simplifications are made. Recently, the phenomenological approach of modeling has emerged as a solution to this issue. They are centered in modeling the process of interest based on empirical observations rather than on the physical laws governing the phenomena. We present in this work some of our experience with the mathematical modeling of mechanical systems using both approaches. Additionally, we present some of the signal processing tools typically used in failure diagnosis. Finally, the concept of cyclostationarity –as opposed to stationarity,– and some applications, is presented.