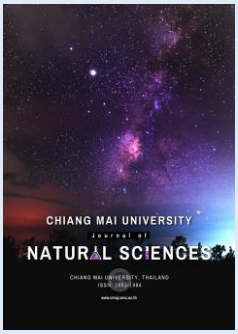

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Research article

Smart Mechanical Systems for Manufacturing in the Era of Industry 4.0: Condition-Based Predictive Maintenance and Dynamic System Modification for Small and Medium-Sized Enterprises

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Abstract We are in the era of the fourth industrial revolution. Which highlights adaptability, monitoring, digitisation and efficiency in manufacturing as a result of the design of new smart mechanical systems. A central role in Industry 4.0 is played by maintenance and, within this framework, we define and review condition-based predictive maintenance. Thereafter, we propose a new class of smart mechanical systems that self-optimise utilising both condition-based maintenance and dynamic system modification. Akin to smart structures, smart mechanical systems will recognise and predict faults or malfunctions and, subsequently, self-optimise to restore desirable system behaviour. Potential benefits include increased reliability and efficiency while reducing cost without the requirement of highly skilled technicians. Thus, small and medium-sized enterprises are a specific target of such technology due to their increasing level of automatisation within Industry 4.0.

Keywords: Condition-based predictive maintenance, Condition monitoring, Dynamic system modification, Small and medium-sized enterprises

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