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Uporaba entropije v diagnostiki in degradacijskih procesih

Michael D. Bryant
Accenture Endowed Professor

Profesor M.D. Bryant iz University of Texas at Austin (Mechanical Engineering) bo predaval na temo uporabe entropije kot temeljnega merila za analizo degradacijskih procesov in njene uporabe v diagnostiki. Nekatere ideje predavanja je prof. Bryant s sodelavci v avgustu 2008 objavil v *Proceedings of the Royal Society A – Mathematical Physical and Engineering Sciences.*

Predavanje bo:

v ponedeljek, 18. 5. 2009 ob 12:00
v predavalnici II/3B na Fakulteti za strojništvo, Aškerčeva 6

Prof. Bryant je avtor večjega števila visoko citiranih znanstvenih člankov iz področij tribologije, dinamike sistemov, termodinamike. Je avtor več patentov, med drugim tudi mednarodnega patenta na temo hibridnega računalnika za zelo hitro reševanje velikega števila diferencialnih enačb. Na University of Texas (UT) predava: Dynamic Systems & Control, Lubrication, Wear & Bearing Technology in Manufacturing Processing: Unit Processes. Poleg tega je na UT še **direktor programa** Manufacturing Systems Engineering in sodeluje v Computational & Applied Mathematics programu.

Prof. Bryant je med drugim tudi:

Editor in Chief: - ASME Journal of Tribology
Series Editor: - Dynamic Systems & Control and Mechatronics,
- Springer Mechanical Engineering Series.

Prof. M.D. Bryant prihaja na FS na povabilo doc. J.Slaviča, ki je bil v letih 2005-06 pri njem kot post-doc raziskovalec in izr.prof. M.Kalina, ki sodeluje z njim kot Associate Editor pri ASME Journal of Tribology.

Vljudno vas vabim, da se udeležite predavanja svetovno priznanega znanstvenika!

Ljubljana, 11. 5. 2009

prof. dr. Jožef Duhovnik
Dekan

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Entropy of Diagnostics and Degradation

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Entropy will be introduced as a fundamental parametric measure of degradation and diagnostics. *Physical entropy* produced by any dissipative irreversible process, can be related to degradation. Manufacture transforms nature's raw materials into highly organized finished components, reduces entropy and increases thermodynamic energies.

Aging or degradation, which tends to return these components' materials back to natural states, must increase entropy and reduce thermodynamic energies, to be consistent with the laws of thermodynamics. The production of irreversible entropy by dissipative processes will be shown to correlate to the amount of degradation by wear of boundary lubricated sliding specimens, and via the Degradation Entropy Generation Theorem will lead to formulations consistent with different wear laws. *Information entropy*, the fundamental measure in communications engineering of amount of information contained in signals, will serve as the basis of a model and information theory based diagnostics method. We view a machine as a "machine communications channel", through which power and information must flow. Each component along the "machine channel" performs a function to organize power flow, and a desired signals flows through the machine. Errors from broken or degraded components disrupt this organization, and concomitantly, the implicit information and signal processing. With this analogy between a communications channel and a machine, Shannon's information theorems that employ information entropy can be applied as a metric to quantitatively assess machine functionality, including failure. We applied Shannon's theorems to detailed models of machines—motors, gears, pumps, ovens, tools, etc.—with the models' parameters tuned from signals measured off the machine. We assessed the present and future health of the machine in terms of its ability to perform a function within a given tolerance.

Michael D. Bryant received a B.S. in Bioengineering from the University of Illinois at Chicago in 1972, spent 2 years in graduate school in Electrical Engineering at UIC, and then obtained an M.S. in Mechanical Engineering and Ph.D. in Engineering Science and Applied Mathematics from Northwestern University in 1980 and 1981. He is the Accenture Endowed Professor in Mechanical Engineering at the University of Texas at Austin. His teaching and research interests involve tribology, mechatronics, mechanics, design and manufacturing. He is Editor in Chief of ASME Journal of Tribology, a fellow of ASME, and member of IEEE and Sigma Xi.