MIRCE Science

The philosophy of MIRCE Science is based on the premise that the purpose of existence of functional systems is to do a work, which is perceived as delivering of function through time, like transportation, communication, computation, protection, and others, with measurable functionality performance, like speed, capacity, frequency, power and similar physical properties. As all physical phenomena associated with functionality performance are characterised by certainty, reversibility and independence of time, location and human influences, it can be accurately predicted, at the design stage, by applying known laws of natural sciences, such as: Newton's laws of motion, Maxwell's law of electrodynamics, Coulomb's law of solid friction, Boltzmann's law of thermodynamics, Hook's law of stress and strength, to name a few.

While doing the work, functional systems are exposed to complex interactions between their consisting parts on one hand and the impacts of natural environment and human actions, on the other. As result a variety of mechanical, electrical, chemical, thermal, radiant and other types of energy are generated, some of which affecting the ability of systems to function, known as functionability[1]. Hence, actions like servicing, repairing, testing, replacing, changing the mode of operation and similar must be performed on functional systems to enable them to continue doing the work. Experience teaches us that the information regarding functionability performance of functional systems, namely the amount of work[2] done by and on the system and the resources used for both, is almost non-existent at the beginning of their in-service life. The reason being, all associated functionability phenomena are characterised by uncertainty, discontinuity, irreversibility, inseparability, and are dependent on time, location and human influences. Hence, the known laws of natural sciences cannot be used to predict functionability performance of functional systems.

To seek the body of knowledge that enables the accurate predictions of functionability performance of future functional systems to be made, at the design stage when it is possible to achieve the best compromise between competing solutions, rather than to wait for the users to measure functionability performance, Dr Jezdimir Knezevic resigned from the Research Centre for Managing Industrial Reliability, Cost and Effectiveness, MIRCE, at Exeter University in UK, in 1999, to established the MIRCE Akademy at Woodbury Park, Exeter, UK. Staff, Fellows, Members and students of the Akademy have endeavoured to subject in-service behaviour of functionable systems[3] to the proven methods of science and mathematics to:

1. Experimentally observe and measure their functionability performance that are quantified through the work done by a functionable system (positive) and the work done on functionable system throughout in-service life (negative), together with the resources consumed in these processes, to determine the patterns of their behaviour in respect to time.
2. Scientifically understand physical phenomena and human actions that govern occurrences of functionability events[4] through life of functionable systems to the level of the dimensional fidelity ranging from the atom (10^{-10} metres) to the Solar System (10^{10} metres).
3. Mathematically describe the observed physical processes of doing positive and negative functionability work through time by a given functionability system, which are characterised by uncertainty, discontinuity, irreversibility, inseparability, and dependence on time, location and humans.

Decades of research have generated a theoretical body of knowledge, named MIRCE Science, which comprises of mathematical equations and computational methods that enable predictions of functionability performance of a given functionability system to be done, at the design stage, driven by: the physical properties of functional systems, given rules (related to the operational scenario, environmental conditions, maintenance policies, support strategy) and in-service constraints.

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[1] Functionability, n. ability to deliver expected function, Knezevic, J., Reliability, Maintainability and Supportability – A probabilistic Approach, Text and Software package, pp. 291, McGraw Hill, London 1993. ISBN 0-07-707691-5

[2] Boeing 747, registration number N747PA, been air born 80,000 hours, transported 4,000,000 passengers, burned 271,000,000 gallons of fuel while receiving 806,000 man-hours of maintenance and consuming: 2,100 tyres, 350 brake systems, 125 engines, among other parts, during the 22 years of in-service life, at Pan Am airlines.

[3] Functionable system constitutes of a functional system and the set of the rules that govern associated functionability processes, responsible for delivering functionability performance

[4] Any event, induced by nature or humans, which impacts the functionability performance of functionable systems.