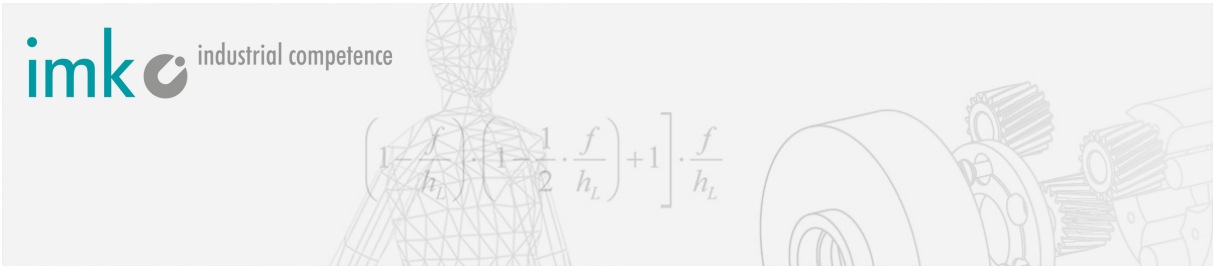

Lecture on »IFF-Wissenschaftstage«, June 2012 in Magdeburg, Gemany

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The »Numerical behaviour model of humans« – Simulation of workers with stress

In the digital factory the simulation of manual work is limping behind the technical simulation, although the most potential of optimisation is in the field of manual activities. Under the conditions of increasing age of personal and the interest of the management to make better ergonomic workplaces it is necessary to qualify the avatars of working men and woman. Not only the normal situation is interesting, also working under stress and overload has to be investigated and simulated.

Imk automotive GmbH since many years has experts for simulation of manual work and develops application software. After the solutions for normal situation simulation – it means the normal average job performance of the healthy, fit worker – now the change of behaviour for workers under stress has to be simulated. The kind of stress can be physical or psychical. Indeed, there exist many medical investigations, but there is no inclusion of the results in human model used in simulation software.

That's why imk automotive GmbH developed »The Numerical behaviour model of humans«, in German »Das Numerische Verhaltensmodell des Menschen«, which is shown to the experts first time in this lecture. Start point of this model is the numerical description of strain and load. Including the individual different resilience of various men the workers are divided in types. The kinds of strain and load, depending on and as the result of the situation, are scaled for the actual worker type. At first the strain and load components are calculated in the model to stress and load at a first summation point. The calculation follows functions, which can be proportional or integrative over the time. Habituation, de-habituation, progression and diminishing, escalators and de-escalators are involved in the calculation functions. Different kinds of stress were built. After the first summation point a recreation function decreases the different kinds of stress, different quickly.

At the second summation point the stresses are non-linear added to a global level of stress of the worker. That's done to avoid several kinds of stress in the further calculations. In a third step are calculated four values, which describe the behavior of the worker: the working speed, the accurateness of the work execution, the probability of mistakes and the probability of refusal of work. The scale of the first both is from 100 % to 0 %, the scale of the latest both is from 0 % to 100 %. Those values can be used to control the simulation of manual work activities and within to show what happens in an industrial manufacturing or assembly line, if the workers are overloaded. The model has now inductive scientific nature. It has to be validated by experts. First steps are done in imk automotive GmbH, but in further investigations more factors for the existing mathematical functions must be exactly validated. A first use is in the simulation system emaϕ – the »Editor of manual activities« of our company.