NEW ITEMS IN PROBLEM SOLVING PROCESS
WHEN USING SUPERCOMPUTING

The typical process of research and development problem solving in connection has changed significantly due to higher penetration of supercomputing (HPC) tools. HPC may support primarily simulation efforts, but nowadays we can use them in the highest level problem solving also. We are examining the effects of changing processes themselves via a case study. As a case, we are using the current INFCARE8 R&D&I project at the 'Szechenyi Istvan' University. This article attempts to generalise all observations that emerged during the implementation.

Historians concluded that currently used elements of innovation processes have achieved their goals in a divergent extent in the last 2500 years. They have been used widely; however, we have only been able to talk about a defined and consequent system since Galilei and Newton. Regulated processes were formed even later, in the 19th century.

There are three traditional elements of creating a model of the problem solving way of thinking. These are the following:

- First, we have to find the characteristics with the help of which we are able to define the problem in a measurable and intelligible way.
- Then comes the setting of the model where we have to find the main point of the problem with the help of the model.
- Drawn consequences from the model should be compared with practical experience and if it is necessary on the basis of the feedback, we should change the model.

Now, on the basis of the experiences of a self-designed and concluded project, we are attempting to create a new innovative form of the traditional problem solving process with the help of using 3D modelling. This was successfully applied by the Szechenyi Istvan University and the Humansoft Ltd. In a research and development project within the scope of the National Technological Program, announced by the legal predecessor of the Nemzeti Innovációs Hivatal (National Innovation Office). The topic of the project was Development of Mechatronic and Informatic Environment Integrated to the Home Nursing of Chronic Child Patients.

The process of problem solving was described as a management cycle by the professional literature in the past decades. These cycles show the order of standard, general management activities and they tighten, enlarge or modify it according to the specialities of the question. In case of definitely commercial product development more cycles are common that considers several points of view. The so called Landsvater spiral is well known and uses four points of view in the repetitive cycles: defining the new idea, technical points of view, market, commercial, and economic points of view, then during the following cycles the product is being modified on the basis of the above mentioned viewpoints.

If we adjust the process of problem solving that uses current tools to the innovation activity, then a modified process comes to life. The main purpose of this is to create products that do not exist at the moment. The stages of the modified process could be the following:

- The first stage is a creative phase, characterised by connected activities in connection with the idea,
- Second stage is creating the conception where results could be communicated widely,
- During the third stage project suggestions emerge from which the realizable versions are chosen.

Realization also happens through several stages, because developments are executed with the help of several cyclically further developed models. The modified process of problem solving is expanded with two main modules:

- 3D computer modelling,
- 3-stage modelling during realization.

3D computer modelling is mainly a geometric modelling in this case and tested virtual reality technologies can also be used.

During the realization of 3-stage modelling, first, a 'plank model' is set up; this is the first tangible implementation of the expected result. In the course of further development a 'functional model' is made, however, realization also starts from the beginning. In the third similar cycle, the full value solution is developed. It can really be expected to be evaluated by the person who is responsible for making the decision. Certainly, the number of cycles can increase, because 'mini-cycles' can be formed after each stage when we are getting into the core with the feedback. Beside technological viewpoints, other points of view also have to be considered.

To carry out R&D tasks we need to employ more and more resources, because of using new tools. The more precise a physical model is and the less time period we examine the more resources the different measuring analysing and simulating applications use up. Development is in the direction of increase in the extent and complexity of tasks, so the number of variations will also grow.

Nowadays, „High Performance Computing Application" users form a community that works on the basis of fully developed rules. Such communities can primarily be found at university research labs. It is a real global activity with its own advantages and disadvantages.

The previously mentioned project, which was carried out at the Szechenyi Istvan University, partly used these tools. At our university, several researches are being carried out where high performance computing is needed on the fields of pure mathematics and physics, applied engineering calculations, quick prototype development and visualization. Applicable means are more and more up to date. Our inventory has been completed with a 3D scanner and a 3D printer that is able to visualise virtually any forms.

The above mentioned R&D project, namely the Development of Mechatronic and IT Environment Integrated to the Home Nursing of Chronic Child Patients aimed to develop a system that is an IT and mechatronic system based on a well prepared, deliberate conception. Info-communication assisted solutions represent the increase of efficiency of the different processes. Experiences gained during the realization of the project confirm that increase in efficiency can only be reached by increasing the speed, ability of scheduling and scansion of processes and the ability to plan the expenses.

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