Industrial Projects of the Department of Computational Optimization

1. For one of the market leading building ventures of Hungary we have investigated the problem how to cut off preset size and number of pieces of different profile, 18 meters long iron rods in such a way that the waste is minimal. Another problem was to minimize the number of useless part (due to the costs of their deposition). The developed new algorithm was by more than 1% better than the previously applied one. Regarding the high material costs in the magnitude of tens of millions of Euros per year, the few months work of two persons involved brings a substantial profit. The suggested algorithm is now incorporated into the production support program of the given venture, they use it, and sell the implemented program since that time.

2. One of the two leading airplane construction firms of the world studied with which angle the sheets of the airplane wall should be glued together in such a way that a given rigidity is achieved and the weight or the cost is minimal per square meter. The problem can be formulated as a 5-10 dimensional complicated nonlinear optimization problem with nonlinear constraints. The set of feasibility was not connected, it could e.g. contain holes. The real challenge was however that the better the usual approximate solutions were (obtained by stochastic techniques), the larger was the chance that not absolutely precise production resulted in a structure that hurt some of the constraints. In this way the security risk increases.

With several man-years of work we have developed the methodology of optimization with tolerances. With this we were able to solve real life problems within minutes on PCs of the 1990s in such a way that the precision of the production can be given by the user, together with the accepted level of suboptimality. As it was requested by the airplane building firm, we have published our results and method after a 6 months delay.

3. As it was ordered by the European Space Agency, we have investigated with Austrian partners how the new paradigm of clouds can be applied in the solution space mission related problems. The aim was to summarize empirical data in such away that enables the improvement of the success rates of space missions. The key is a better estimation of how often rare events can occur. The study is now completed and accepted by the European Space Agency.

4. We are participants of a big state founded project (with other universities and with a major Hungarian property management firm) that aims to solve scheduling and controlling problems of mission critical delivery. The online algorithm being investigated and developed will be capable to determine an optimal path of the transported goods handling satellite connection, bar code and radio frequency identification devices, among dynamically changing environments and still allowing safe delivery.

5. The earlier mentioned tolerance optimization methodology was applied for the solution of static problems considering the uncertainties in soil conditions, trying to get rid of a part of the usual over-insurance for the planning of building footings. The reliable handling of the large number of complicated nonlinear constraints resulted in a substantial saving while no compromise has been made regarding the security.

6. We have used the experiences collected on the field of verified investigation of dynamic systems also for the solution of practical problems. In this framework new possibilities emerge for the design of industrial chemistry production systems by utilizing the verified determination of fix points and separatrices for reaction networks, that can be utilized to design optimal control with a better cost efficiency - reliably.

7. It is of profound importance for telecommunication providers to increase their market share. This is why they want to provide an attractive choice of services for their future clients, and on the other hand they want to ensure that their income reaches the level allowed by the law. The subscriber packages can be optimized in such a way that both goals are achieved. We have collected much experience in optimizing tariff systems - applying deeper mathematical tools too.

8. For the optimal management of segments in a firm it is important to utilize the human workforce close to the possible maximal level. The scheduling of the respective tasks leads to multiple objective function problems, often
to such that does not have a standard theoretical recipe. The emerged concrete application problems were solved successfully by the help of the theories of scheduling, logistics, and service problems for a telecommunication firm.

Planned further collaboration subjects:

1. The support of text extraction from biological and chemical scientific publications by the help of learning algorithms to speed up the process of the data base building procedure. For this subject we expect the support of a state research grant.

2. A Belgian firm asked us to provide a table containing the number of barrels one can place on a Euro-palette depending on the size of the barrels. The problem was motivated by the fact that the venture selling printing colors placed the barrels slightly over the palette and that resulted for densely packed lorries in the opening of the barrel lids, and the expensive colors were wasted causing also much mess.

3. With a local transportation firm we are about to formalize the problems of determining timetables for them that allow lower costs while complying with the service requirements. A part of the problem is to provide a well based choice to meet several objectives in the same time, such as minimal distance covered, the least number of vehicles used, minimal cost, minimal personal cost etc.

4. With a university from Transylvania (Roumania) we plan a collaboration in the field of reliable control of automatization systems. We plan to utilize the synergy of the partners engineering experience and our knowledge on the qualitative analysis of dynamical systems.

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