

Constraint Patterns: a research proposal

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Many companies have scheduling, assignment, supply chain and other problems that could be solved with a constraint programming (CP) toolkit. Although the solution of these problems is of vital commercial importance, CP toolkits are not widely used because there is insufficient expertise available to model problems as constraint programs. How then can we take the writing of efficient constraint programs out of the realm of research laboratories and specialised consultancies, and into everyday programming practice? How can we release the proven power of constraint programming to a wide user base, and thereby help improve industrial competitiveness?

As in other areas of software engineering, many *patterns* occur frequently in constraint programs. To date, these have only been given informally by practioners, at the level of off-the-cuff remarks in reports. I claim that we need to identify, formalize and document these patterns in a similar way to the patterns identified by the object-oriented programming community. The result will be a systematic and comprehensive methodology for modelling an informal problem specification as a constraint program. This will give us a “cookbook” which can be given to users so that they can effectively and efficiently model problems in a wide variety of different CP toolkits.

This is an ambitious project. Modelling is not a problem which lends itself to a piecemeal approach as even the smallest modelling decision can have far reaching consequences. To be useful, we need to provide patterns for all the most commonly occurring situations in constraint programs across a wide range of applications. The best way to do this is with a large scale project. There are many different aspects of modelling that need to be tackled. For example, in recent work with Barbara Smith and Kostas Stergiou, we have looked at the role of (additional) auxiliary variables in modelling. However, we must also look at many other difficult issues like: symmetry, hybrid models, implied constraints (“Automatic Generation of Implied Constraints” is a new 3 year EPSRC funded research grant starting at York on 1st October 2000), reformulation (“Problem Reformulation and Search” is a 3 year EPSRC funded research grant starting at Glasgow on 1st October 2000), non-binary constraints, redundant models, ...

To prevent ivory tower fascination with toy problems, we need close collaboration between the University researchers and industries with problems suitable for constraint programming. To make the results general and useful, we need to study a wide variety of different CP toolkits. This project will require the skills and resources of all the APES group. For more information about this proposal, see www.apes.cs.strath.ac.uk/patterns.