

# Preface

In this book we summarise the efforts and experiences gained by working with multiobjective optimization techniques in the control engineering field.

Our studies began with an incursion into evolutionary optimization and two major control systems applications: controller tuning and system identification. It quickly became evident that using evolutionary optimization in order to adjust a given controller is helpful when dealing with a complex cost function. Nevertheless two issues were detected regarding the cost function: (1) sometimes minimizing a given index fails to guarantee the expected performance (that is, when it is implemented); and (2) it fails to reflect properly the expected trade-off between conflictive design objectives. The former issue is sometimes simply that the index does not accurately reflect what the control engineer really wants, the latter because sometimes it is difficult to build a cost index, merging all design objectives and seeking a desired balance among them.

That is how multiobjective evolutionary optimization entered into the scene. Sometimes when aggregating design objectives in order to create a single index for optimization, some understanding of the outcome solution is lost. With multiobjective optimization it is possible to work with each design objective individually. Furthermore it is possible to analyse, at the end of the optimization process, a set of solutions with a different trade-off (the so-called Pareto front). Therefore, it is possible to select a given solution, with the desired balance between conflictive design objectives.

From there, a lot of work has been carried out on identifying applications, developing optimization algorithms and developing visualization tools. The book is part of a bigger research line in evolutionary multiobjective optimization techniques. Its contents focus mainly on controller tuning applications; nevertheless, its ideas, tools and guidelines could be used in different engineering fields.

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Gilberto Reynoso Meza  
Xavier Blasco Ferragud  
Javier Sanchis Saez  
Juan Manuel Herrero Durá

Controller Tuning with Evolutionary Multiobjective  
Optimization

A Holistic Multiobjective Optimization Design Procedure

Reynoso Meza, G.; Blasco Ferragud, X.; Sanchis Saez, J.;  
Herrero Durá, J.M.

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