Multi-objective optimization techniques in control systems engineering
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Abstract: Control engineering problems are generally multi-objective; several specifications and requirements must be fulfilled, often in conflict. A traditional approach for calculating a solution with the desired trade-off is defining an optimization statement. Multi-objective optimization techniques deal with such a problem from a particular perspective by searching for a set of potentially preferable solutions: the so-called Pareto set. The designer may then analyze the trade-off among solutions in this set and select a preferred alternative according to the problem. This open track aims to provide practitioners the opportunity to exchange ideas and share potential applications of multi-objective optimization techniques in control systems engineering. This track follows its previous editions in 2017 and 2020 and focuses on using or extracting information from a Pareto front approximation to solve a control problem. Topics covered (but not limited to) include insights, tools, and theoretical developments on:

- Multi-objective problem definition;
- Multi-objective optimization process;
- Multi-criteria decision making stage;
- Modelling for control;
- Controller design and tuning.

Keywords: Evolutionary algorithms in control and identification, Soft computing in control, Multi-objective optimization, multi-criteria decision-making.

1. OPEN INVITED TRACK DESCRIPTION

Control engineering problems are generally multi-objective problems; that means that there are several specifications and requirements that must be fulfilled, often in conflict. A traditional approach for calculating a solution with a desired trade-off is defining an optimization statement. Multi-objective optimization techniques deal with such problem from a particular perspective by searching for a set of potentially preferable solutions: the so called Pareto set. The designer may then analyze the trade-off among solutions in this set, and select the most preferable alternative according to the problem at hand. The aim of this open invited track (OIT) is to provide the opportunity among practitioners to exchange ideas and to share potential applications of multi-objective optimization techniques in control systems engineering. This OIT focuses on using or extracting information from a Pareto front approximation, in order to solve a control problem.

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Topics covered (but not limited to) include insights, tools and theoretical developments (always within the control systems engineering framework) on:

- Multi-objective problem definition: design objectives statement, constraints definitions, decision variables, pertinency and/or preferences statement.
- Multi-objective optimization process: local or global search; mechanisms for handling constraints, preferences, many-objectives optimization instances.
- Multi-criteria decision-making stage: decision-making techniques; tools and methodologies for visualization and selection.
- Modelling for control. Multi-parameter or complex structures adjustment for linear and non-linear models using multi-objective optimization tools.
- Controller design and tuning. Control scheme selection and tuning based on multi-objective optimization.

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