Hochschule
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Laboratory for
Mechatronic
and Renewable
Energy Systems
(LMRES)

Multi-objective optimization: An introduction (A naive approach)

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Outline I

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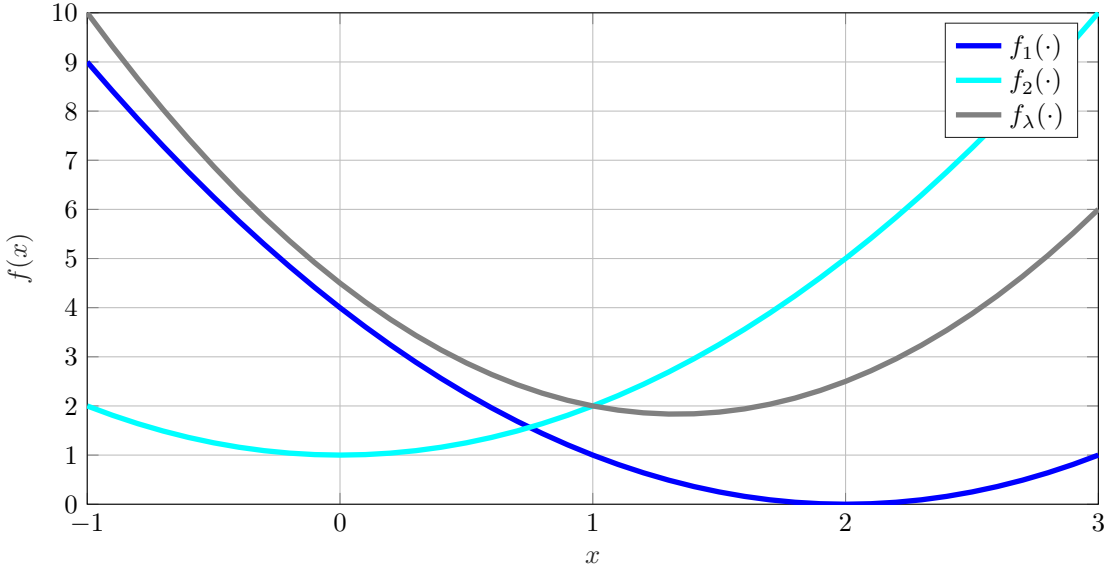
Multi-objective optimization

Motivating example: $f_1(x) := (x-2)^2$, $f_2(x) := x^2 + 1$ and $f_\lambda(x) := f_1(x) + \lambda f_2(x)$ $[\lambda = \frac{1}{2}]$



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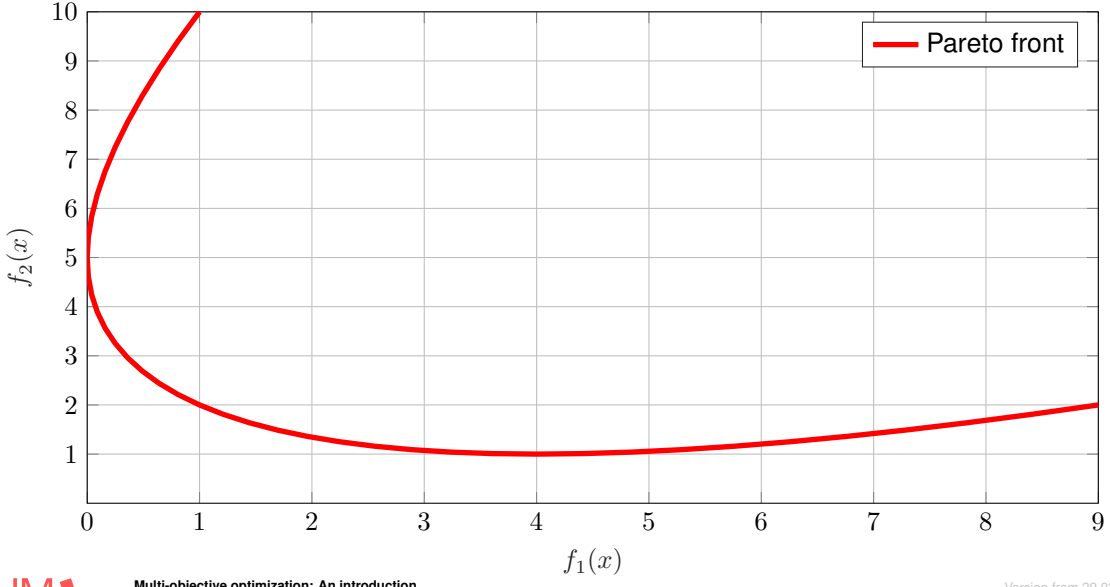

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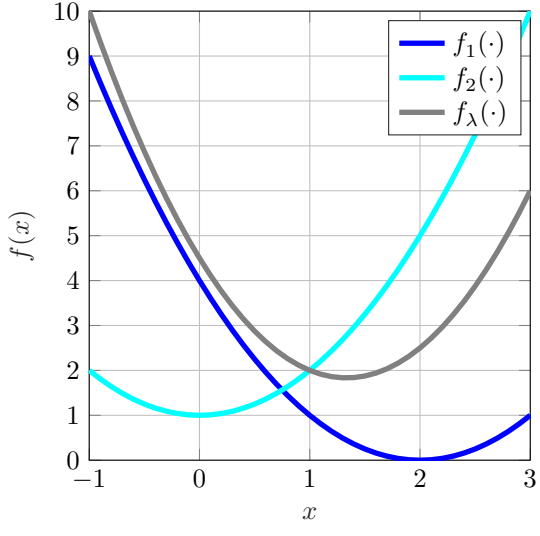

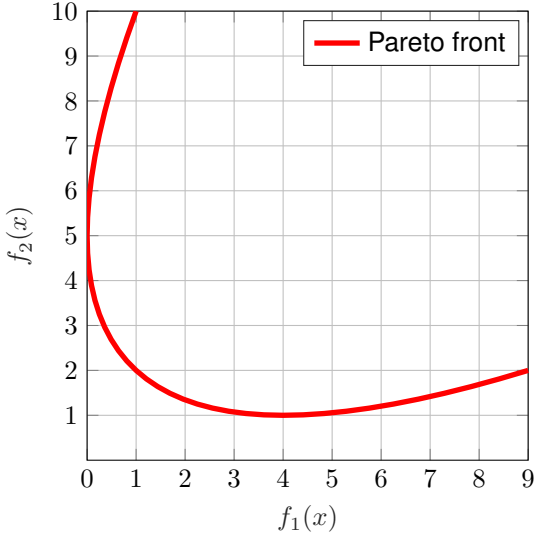

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Multi-objective optimization

Key questions

(KQ1) Can we minimize both sub-costs $f_1(x) := (x-2)^2$ and $f_2(x) := x^2 + 1$ simultaneously? ... and how does the Pareto front help here? What is the “best” trade-off? Is there a “best” trade-off?

(KQ2) Does there exist an optimal $\lambda^\star$ such that $f_\lambda(x) := f_1(x) + \lambda^\star f_2(x)$ minimizes both sub-costs? How can we find $\lambda^\star$? Or should $f_\lambda(x)$ be defined differently?

(KQ3) What can we do when $f_1(\cdot)$ and $f_2(\cdot)$ are not known? How can we analyze the impact of parameter uncertainties?

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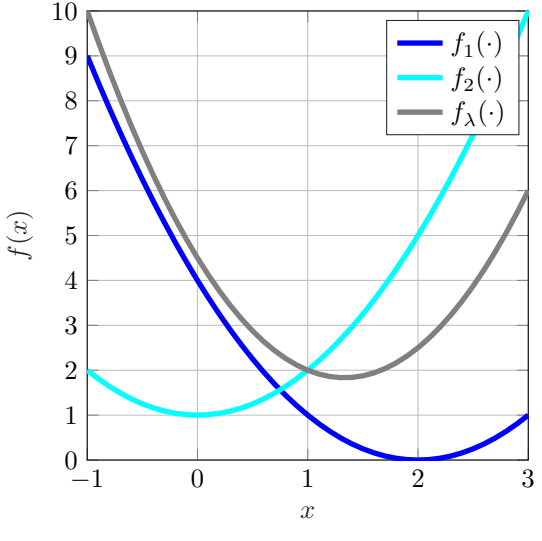

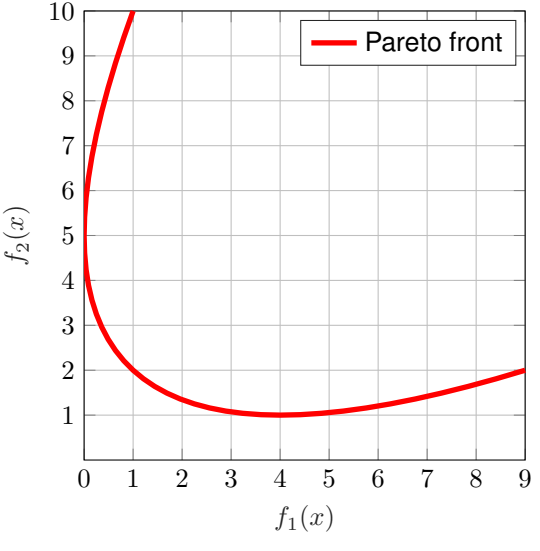

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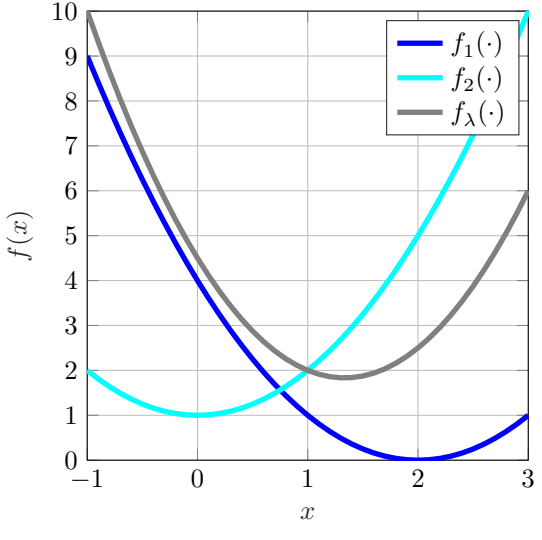

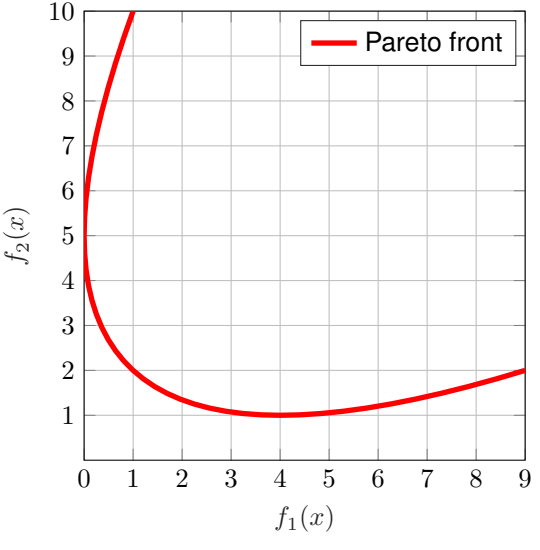

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