



Contribution ID: 20

Type: **Talk**

Model and solve optimal control problems with ODE's in Julia

Tuesday, October 29, 2024 11:00 AM (30 minutes)

We first introduce in this tutorial the indirect shooting method and the direct method in numerical optimal control on a basic example. We focus on the use of Julia packages to implement such methods: JuMP.jl [1], OptimalControl.jl [2, 3, 4], NonlinearSolve.jl [5], MINPACK.jl [6]. Then, we present how to combine direct and indirect methods to solve an optimal control problem with a Bang-Singular-Bang optimal structure. The idea is to use the direct method to determine the optimal structure and find an initial guess, respectively to define the shooting function and solve the associated shooting equations. Automatic differentiation is crucial at any step of the resolution as we will see.

[1]: <https://github.com/jump-dev/JuMP.jl>

[2]: <https://github.com/control-toolbox>

[3]: JuliaCon 2023

[4]: Caillaud, J.-B., Cots, O., Gergaud, J., Martinon, P., & Sed, S. OptimalControl.jl: a Julia package to model and solve optimal control problems with ODE's. <https://doi.org/10.5281/zenodo.13336563>

[5]: <https://github.com/SciML/NonlinearSolve.jl>

[6]: <https://github.com/sglyon/MINPACK.jl>

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