Global Optimal Control using Direct Multiple Shooting

H. Diedam[1] **and S. Sager**[2]

Abstract: Motivated by state-of-the-art algorithms for mixed integer optimal control problems (MIOCP), where lower bounds on the solution are necessary, we developed a numerical method to combine direct multiple shooting with convex relaxation techniques for optimal control problems. Embedded into an extended branch and bound framework and applied to a MIOCP with relaxed integer decisions, the lower bounds on the solutions allow to determine if the objective value of the resulting optimal control problem is, at least up to a desired epsilon accuracy, close to the global solution. Afterwards, we apply integer approximation methods like the $Sum\ Up\ Rounding$ strategy to the relaxed solution in order to obtain arbitrarily close approximations of the global integer solution for a wide range of MIOCPs. Finally, we present first numerical results on selected benchmark problems from the literature and new challenging problems including mixed integer decisions with relaxed problems that exhibit multiple local minima.

[1,2] Interdisciplinary Center for Scientific Computing
University of Heidelberg
Im Neuenheimer Feld 368, 69120 Heidelberg, Germany
{*holger.diedam, sebastian.sager*}*@iwr.uni-heidelberg.de*