Phase

NLP Func Util

User Fun Util

User Func Interface

User Func

NLP Data

Trajectory

Optimizer Interface

Optimizer

Dec Vector

1

2

3

4

|  |  |  |  |
| --- | --- | --- | --- |
| Quad Defect |  | x |  |
| Quad Cost |  | x |  |
| Alg. Path |  | x |  |
| Alg. Boundary | x |  |  |
| Alg. Cost | x |  |  |
| Linkage | ? |  |  |
| Shooting |  |  | x\* |
| NLP Func Util Leaf Classes | **Point**  **Functions** | **Path**  **Functions** | **Prop\***  **Function** |

Key Interfaces

* 1. Phase calls methods on UserFunUtil updates state information on the utility to prepare user functions for evaluation. Then Phase calls Evaluate on User Fun Util to trigger function evaluation. Finally, phase sends UserFunUtil an instantiation of the appropriate function types(Point, Path, etc) and the UserFunUtil fills in the function values and passes back to phase.
* 2. Phase sends vectors of UserFunctions to the appropriate NLPFuncUtil type to compute/transcribe the user functions to NLP functions. NLPFunc computes a “standard form” for the functions on the NLPFuncData class (not shown)
* 3. Performed during initialized. UserFunUtil provides a pointer to its data to the NLPFuncData class.
* 4. Phase sets the decision vector on the decision vector class. During the evaluation of user functions, phase requests the state, control, etc at given mesh/stage points. DecVec provides the state and contrl to Phase, along with the indeces of those variables in the decision vector. The indices are used later to ensure Jacobian chunks are inserted in the right place by the NLP Func Utile

Key Data

* The decision vector (Vector of Optimization variables for a phase) is store on DecVector class.
* Cost Function, Constraints, and Jacobian for the multiphase problem is bookept by NLPData class.
* NLPFuncUtil computes different types of NLP functions and provides pointers to function data to the NLPData class. This avoids duplication of large vectors and arrays.

The Optimal Control Problem Statement

Subject to the dynamics constraints

The algebraic path constraints

The integral constraints

And the boundary conditions

Where