CasADi for solution of a Nonlinear Program

Lecture 01C
CasADi and the Himmelblau Optimization Problem

John Bagterp Jørgensen

Department of Applied Mathematics and Computer Science
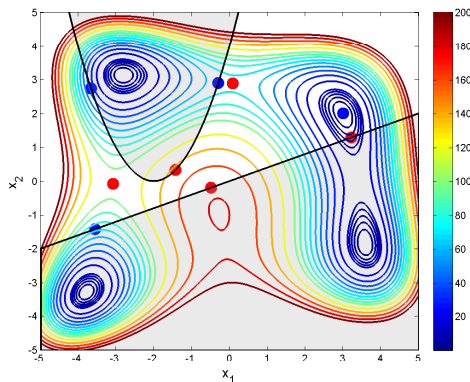Technical University of Denmark

02612 Constrained Optimization

The Himmelblau Optimization Problem

$$\min_{x} \quad f(x) = (x_1^2 + x_2 - 11)^2 + (x_1 + x_2^2 - 7)^2 \tag{1a}$$

$$c_1(x) = (x_1 + 2)^2 - x_2 \geq 0 \tag{1b}$$

$$c_2(x) = -4x_1 + 10x_2 \geq 0 \tag{1c}$$

The Himmelblau Optimization Problem

▶ Himmelblau's optimization problem

$$\min_x \quad f(x) = (x_1^2 + x_2 - 11)^2 + (x_1 + x_2^2 - 7)^2 \tag{2a}$$

$$c_1(x) = (x_1 + 2)^2 - x_2 \geq 0 \tag{2b}$$

$$c_2(x) = -4x_1 + 10x_2 \geq 0 \tag{2c}$$

▶ CasADi interface (ipopt interface)

$$\min_x \quad f(x) \tag{3a}$$

$$s.t. \quad x_{lb} \leq x \leq x_{ub} \tag{3b}$$

$$g_{lb} \leq g(x) \leq g_{ub} \tag{3c}$$

CasADi script

```
 1   % example 4 casadi
 2   import casadi.*
 3
 4
 5   % Symbols/expressions
 6   x1 = MX.sym('x1');
 7   x2 = MX.sym('x2');
 8
 9   t1 =  x1*x1 + x2 - 11;
10   t2 =  x1 + x2*x2 - 7;
11   f  = t1*t1 + t2*t2;
12
13
14   c1 = (x1+2)^2 - x2;
15   c2 = -4*x1 + 10*x2;
16   g = [c1; c2];
17
18   nlp = struct;              % NLP declaration
19   nlp.x = [x1;x2];           % decision vars
20   nlp.f = f;                 % objective
21   nlp.g = g;                 % constraints
22
23   % Create solver instance
24   F = nlpsol('F','ipopt',nlp);
25
26   % Solve the problem using a guess
27   res = F('x0',[0.0 0.0],'ubg',1e8,'lbg',0,'lbx',[-5;-5],'ubx',[5;5])
28
29   res.x
```