EE 653 - Numerical Solutions

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Numerical Solutions - Matlab

Matlab `bvp4c`

- Boundary value problems (BVP) for ODE - Matlab `bvp4c` solver
- Finite difference method
- Initial guess supplied at initial mesh points $\rightarrow$ Changes mesh to get the goal accuracy

Application: bvp4c

$\dot{x} = f(t, x)$ with $x(t_0) = x_0$ and $x(t_f) = x_f$

`sol = bvp4c(odefun,bcfun, solinit,options)`

`function dxdt = odefun(t,x)` t-scalar, x, dxdt: vectors

`function res = bcfun(`x_0`,` x_f`)`

x_0, x_f - Column vectors corresponding to the numerical solution.

Output of res - Column vector with the values of residuals in the boundary conditions

Initial Guess

`solinit = bvpinit (t, xinit)`

t - Initial mesh points

- t = `linspace(`t_0`,` t_f`,` `N)`
- $t = [t_0 : \Delta T : t_f]$

sol

Returned by `bvp4c`

- `sol.x` - Mesh selected by
- `sol.y` - Solution at mesh points. If 2nd order BVP,
  - `sol.y(1,:)` - Solution for x;
  - `sol.y(1,:)` - Solution for $\dot{x}$

Options

```
options = bvpset( 'RelTol', 10^-10, 'AbsTol', 10^-4,
'Nmax', 1000, 'Stats', 'off', 'Vectorized', 'on')
```