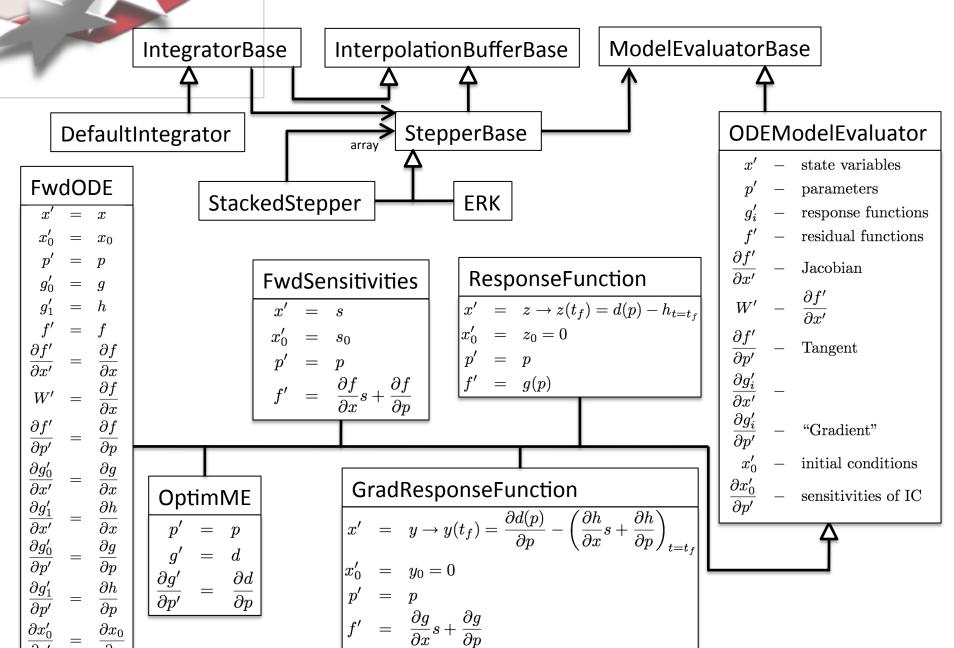


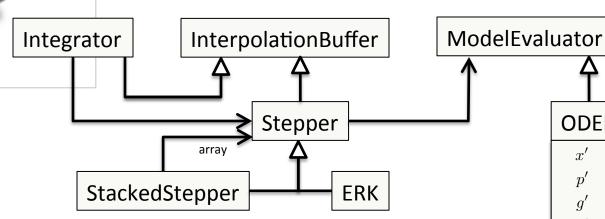
Forward Sensitivities Design for Rythmos



 $\partial p'$

 ∂p

Adjoint Sensitivities Design for Rythmos



ResponseFunction

FwdODE

 $\frac{\partial g_0'}{\partial x'}$

 $\overline{\partial x'}$

 $\partial x_0'$

 ∂h

 ∂x_0

$$x' = z \rightarrow z(t_f) = d(p) - h_{t=t_f}$$

$$x'_0 = z_0 = 0$$

$$p' = p$$

$$f' = g(p)$$

Adjoint Equations

$$x' = \Lambda$$

$$x'_{0} = \Lambda(t_{f})$$

$$f' = -\left(\frac{\partial f}{\partial x}\right)^{T} \Lambda - \left(\frac{\partial g}{\partial x}\right)^{T}$$

ROME

$$p' = p$$

$$g' = d$$

$$\frac{\partial g'}{\partial p'} = \frac{\partial d}{\partial p}$$

GradResponseFunction

ODEModelEvaluator

state variables

parameters

response functions

residual functions

- Jacobian

 $W' - \frac{\partial f'}{\partial x'}$

 $\frac{\partial f'}{\partial p'}$ – Tangent

- "Gradient"

initial conditions

sensitivities of IC

Rythmos Development OO Design

