

Program

```
function F(x)
  if h(x) > 0
    return f(x)
  else
    return g(x)
  end
end
```

Mathematical Expression

$$F(x) := f_1 \circ f_2 \circ \dots \circ f_K(x)$$

$$dF = \frac{\partial f_1}{\partial f_2} \cdot \frac{\partial f_2}{\partial f_3} \dots \frac{\partial f_{K-1}}{\partial f_K} dx$$

code

automatic
differentiation

symbolic
differentiation

∂ Program

```
function  $\partial F(x)$ 
  if h(x) > 0
    return  $\partial f(x)$ 
  elseif h(x) == 0
    return  $\delta(x) * \partial h(x) * (f(x) - g(x))$ 
  else
    return  $\partial g(x)$ 
  end
end
```

symbolic evaluation
requires explicit Jacobians

$$\frac{dF}{ds} = \frac{\partial F}{\partial x} \cdot \frac{dx}{ds}$$

automatic evaluation
of vector-matrix products