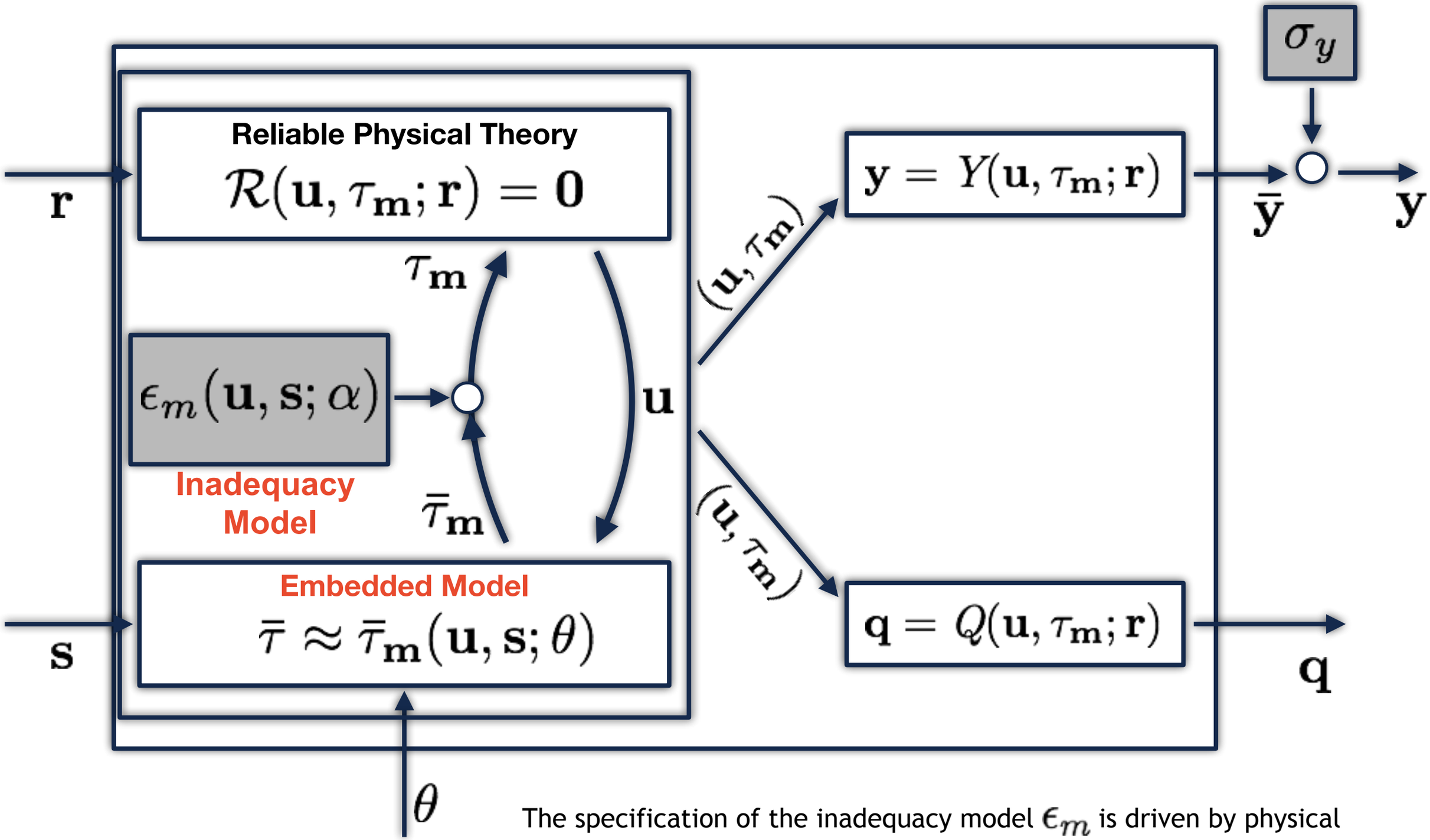
The Predictive Validation Process

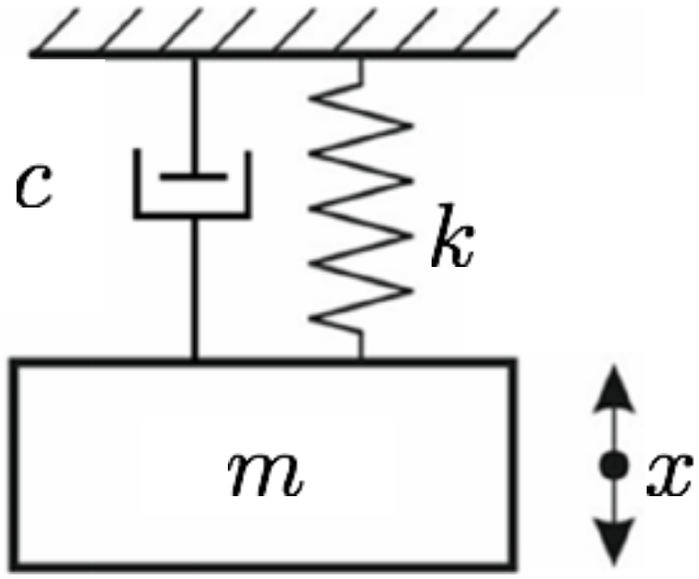
Alternatively, we can move the non-deterministic model **upstream to the embedded component**, which is the main source of uncertainty (generally).



The specification of the inadequacy model ϵ_m is driven by physical knowledge about the nature of the error, and it is problem-dependent.

Introduction

Example: Mass-Spring-Damper, Approximated System



Reliable Physical Theory

$$\mathcal{R}(\mathbf{u}, \tau_{\mathbf{m}}; \mathbf{r}) = \mathbf{0}$$

$$m\ddot{x} + c\dot{x} + kx = 0$$

$$\mathbf{u} = \begin{bmatrix} x \\ \dot{x} \end{bmatrix} \quad \tau = \begin{bmatrix} c \\ k \end{bmatrix} \quad \mathbf{r} = \begin{bmatrix} m \\ x(0) \\ \dot{x}(0) \end{bmatrix}$$

Approximated Embedded Model

$$\bar{\tau}_m = (\cancel{\mathbf{u}}, \cancel{\mathbf{r}}, \cancel{\mathbf{s}}, \theta)$$

$$k = \text{const}$$

$$\theta = k$$

Inadequacy Model

$$\epsilon_m(\cancel{\mathbf{u}}, \cancel{\mathbf{s}}; \alpha)$$

$$c \sim \mathcal{N}(\mu_c, \sigma_c^2)$$

$$\alpha = \begin{bmatrix} \mu_C \\ \sigma_C \end{bmatrix}$$

$$\mathbf{y} = x$$

$$\mathbf{q} = \max(\dot{x})$$