Introduction

Note: It is critical that parameters be **identifiable** (i.e., parameters can be uniquely determined from observations). For:

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

the parameter sets:

$$\theta = [m, c, k] \quad \text{and} \quad \theta = [1, c/m, k/m]$$

yield the same state values.

Approximated Embedded Mode

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

$$\boxed{k = \text{const}}$$

$$\theta = k$$

Inadequacy Model

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

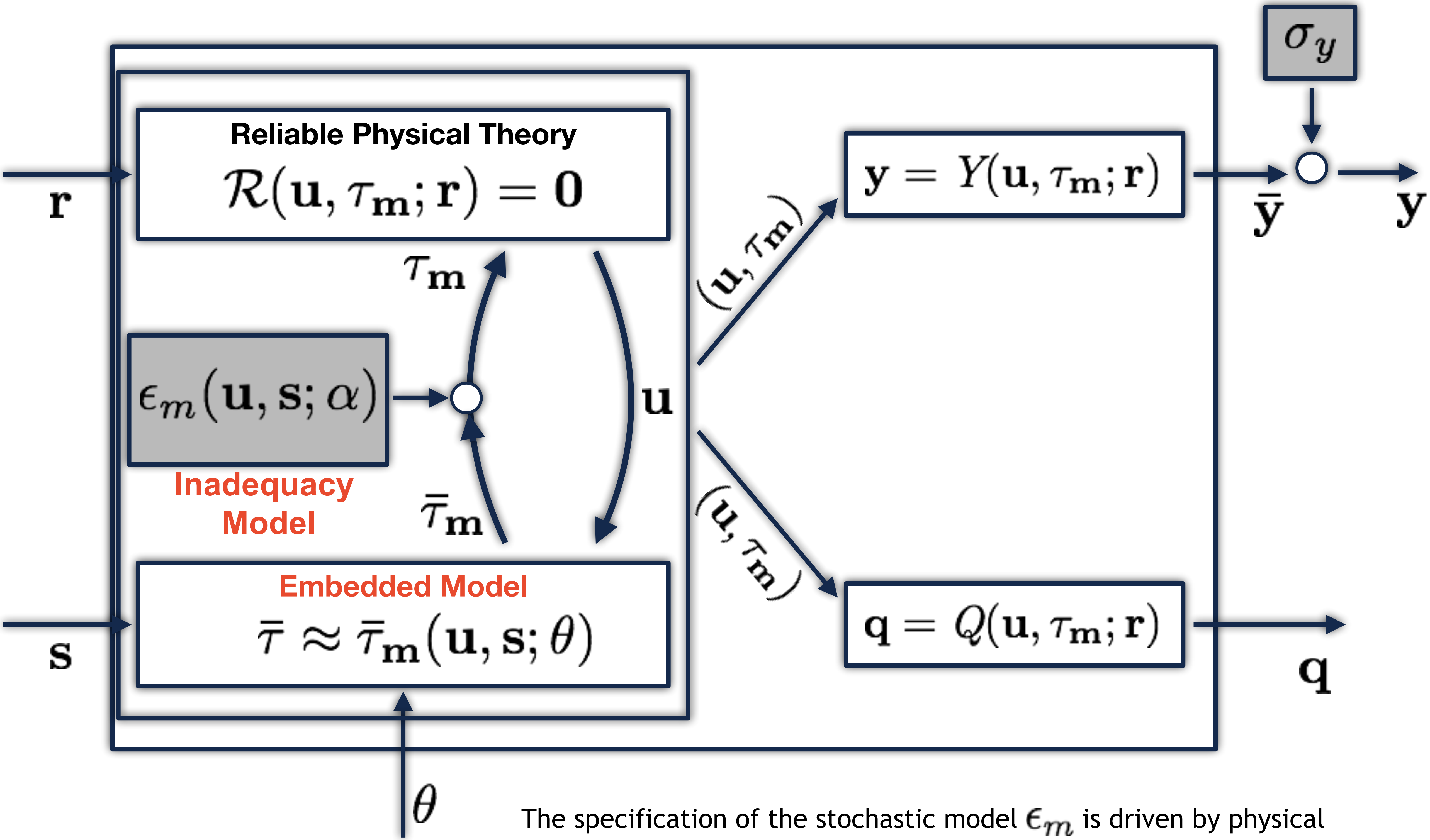
$$\boxed{c \sim \mathcal{N}(\mu_c, \sigma_c^2)}$$

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

$$\boxed{\begin{aligned} \mathbf{y} &= x \\ \mathbf{q} &= \max(\dot{x}) \end{aligned}}$$

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