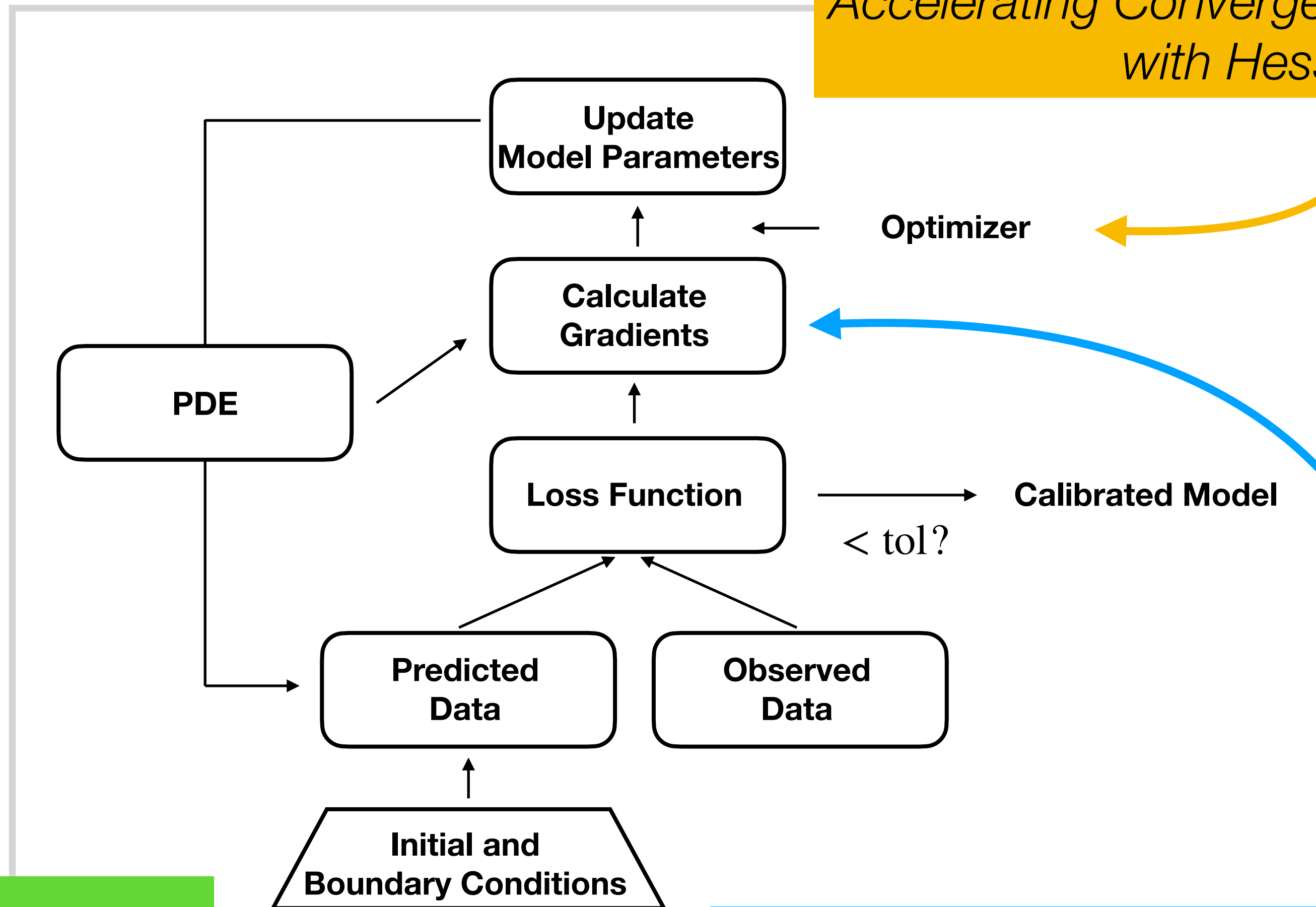


**Contribution 1**  
**Software Implementation**  
*ADCME: Gradient Calculation and Inverse Modeling Pipelining*



**Contribution 2**  
**1st Order Physics Constrained Learning**  
*Calculating Gradients for Implicit & Iterative Operators*

**Contribution 3**  
**2nd Order Physics Constrained Learning**  
*Accelerating Convergence and Improving Accuracy with Hessian Information*