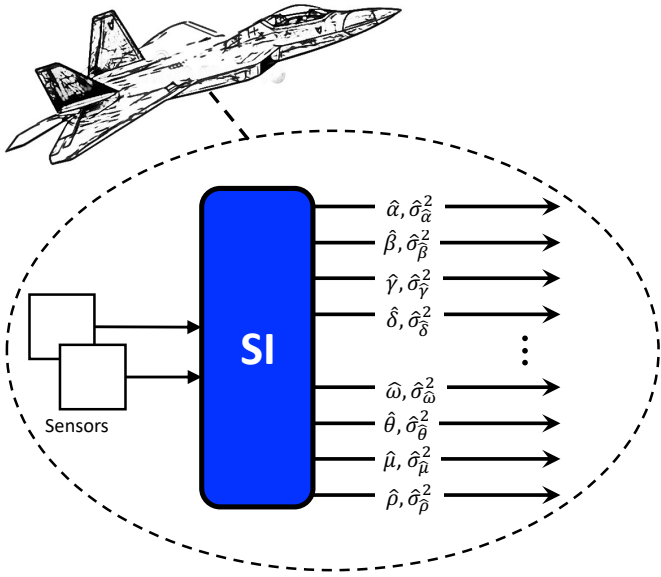


# Spatiotemporal Intelligence (SI)



# Comprehensive failure management applied to your system

## Solution Attributes:

- **AI:** SI is AI software comprising neural networks
- **Uses synthetic training data:** Physics-based. Therefore, a first principles model of the target system, including lumped parameter, CFD models, and correlations can be used to develop the training datasets.
- **Fast development:** Technology development to support your system is rapid, on the order of a few days

## Application of SI to your system

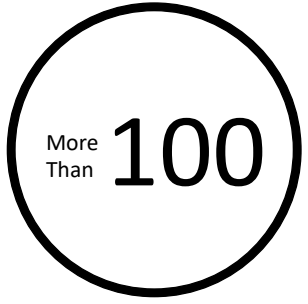
- **SI is non-invasive:** SI can run as an auxiliary monitor, generally requiring only connections to system control inputs and outputs
- **Inherently remote:** SI is avionics software. It can be performed by cloud, edge, or embedded implementation
- **Works online/offline:** SI can be alternately attached to MBSE software, to facilitate hardware testing and development

## Advantage

### Number of Physical Parameters Inferred per Sensed Measurement



All Other Inferential Sensors\*



SI

Stratos Perception, LLC.

Detect and Mitigate Pending Root Causes ... Before Failures Happen

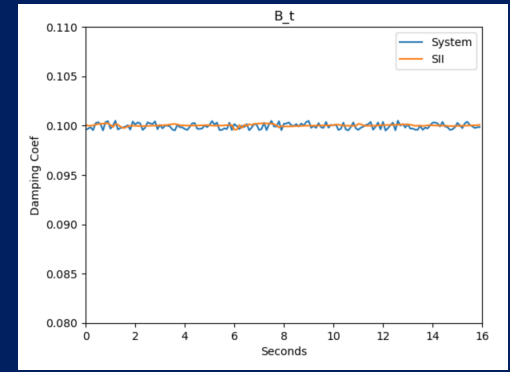
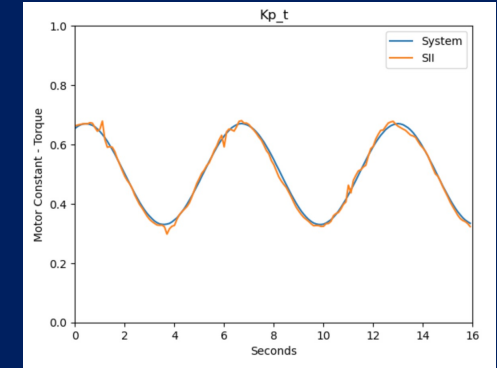
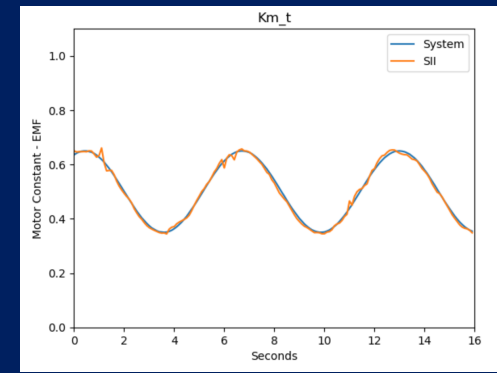
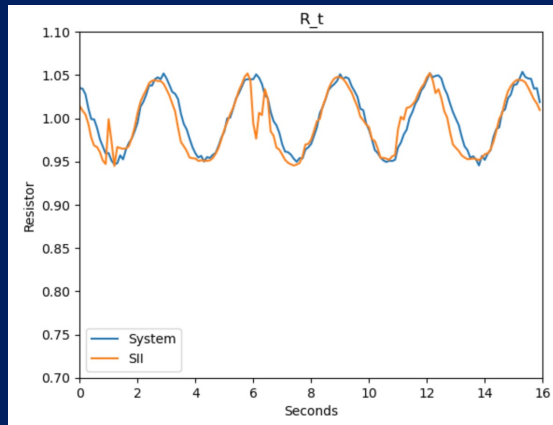
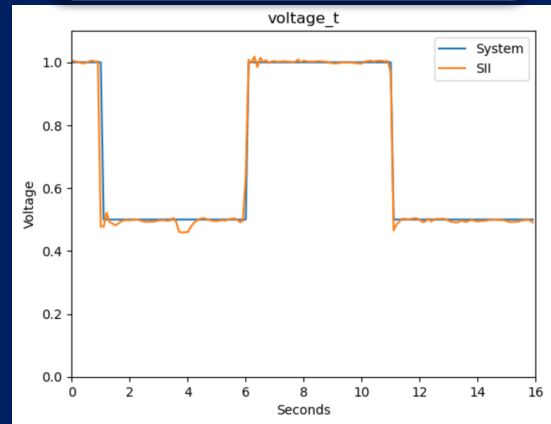
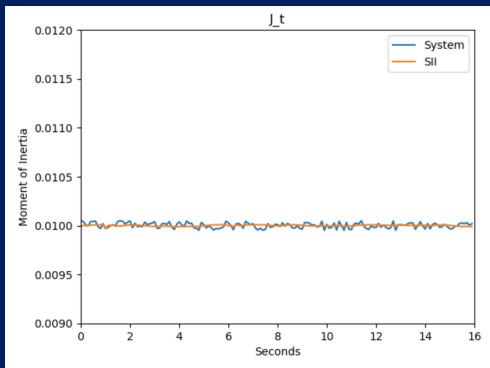
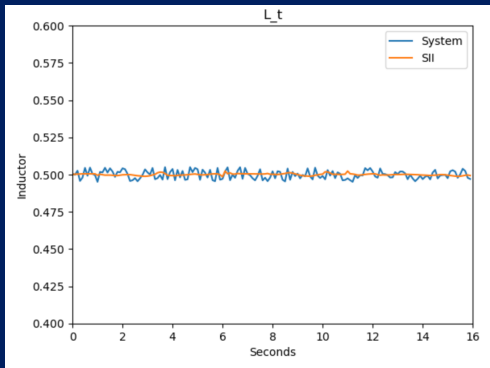
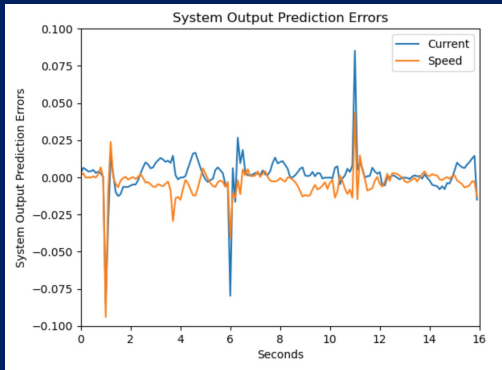


# Demonstration\*

## Simulated Motor Pump

$$\frac{1}{L(t)} \frac{\partial I(t)}{\partial t} = V(t) - R(t)i(t) - K(t)_m \omega(t)$$

$$\frac{1}{J(t)} \frac{\partial \omega(t)}{\partial t} = K(t)_p i(t) - B(t)\omega(t)$$



In this example a motor-pump is simulated via a simple system of ordinary differential equations with all physical parameters time-varying. SI does not receive input that some of the physical parameters of the motor pump are behaving in nonsensical ways. The upper left image is the prediction errors on the two signals that SI is monitoring, current and speed. The other two lefthand images and the lower righthand image represent independent parameters that are simulated as behaving stochastically about a constant mean. The other four images show the values of the remaining four inferentially monitored independent parameters which are simulated with sinusoids and step functions (i.e., voltage, motor emf, motor torque, electrical resistance) with noise. Together, the images demonstrate that SI performs accurate estimation (i.e., *inferential monitoring*) on an underconstrained parameter estimation problem, with two independent sensed signals and seven unknown time-varying independent parameters, estimating all time-varying parameter behaviors based on only the prediction errors obtained from the monitoring of current and speed. \*Realistic units of the physics involved were not considered in this demonstration and therefore units are omitted from the data descriptions.