Westfälische Wilhelms-Universität Münster

Applied Mathematics Münster

The Versatile Cross Gramian

for System-Theoretic Model Reduction and More

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System of Interest

$$\dot{x}(t) = f(x(t), u(t), \theta)$$
$$y(t) = g(x(t), u(t), \theta)$$

(A parametrized input-output system)

Controllability & Observability

$$\mathcal{C} : L_2 \to \mathbb{R}^N$$

$$\mathcal{O} : \mathbb{R}^N \to L_2$$

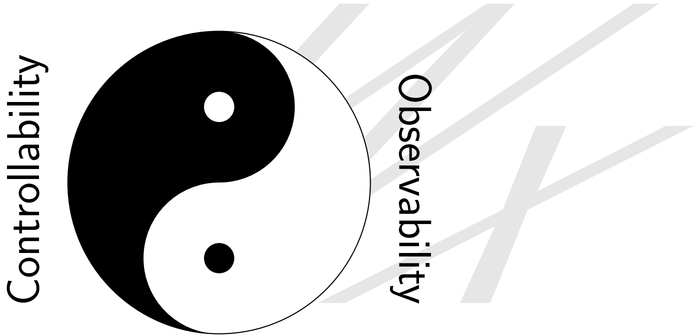
(These dual operators are essential to system theory)

The Cross Gramian (Matrix)

$$W_X := \mathcal{C} \circ \mathcal{O}$$

(aka W_{CO}, introduced by [Fernando & Nicholson'83])

Balancedness



One System Gramian To Rule Them All!

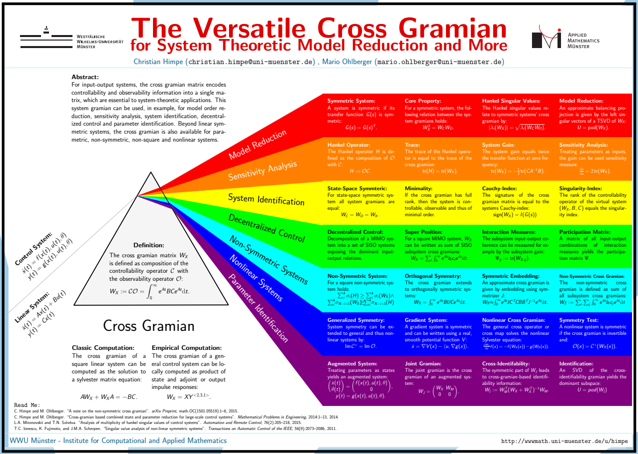
For:

- Model Reduction
- Sensitivity Analysis
- System Identification
- Decentralized Control
- Parameter Identification
- **Combined State and Parameter Reduction**

Of:

- Symmetric Systems
- Orthogonally Symmetric Systems
- Gradient Systems
- Non-Symmetric Systems
- Non-Square Systems
- Nonlinear Systems

Do You Want To Know More?



Come By!