**Beyond the Basics – An Interactive "deep dive" into Vehicle Modeling & Simulation (M&S) Fundamentals**

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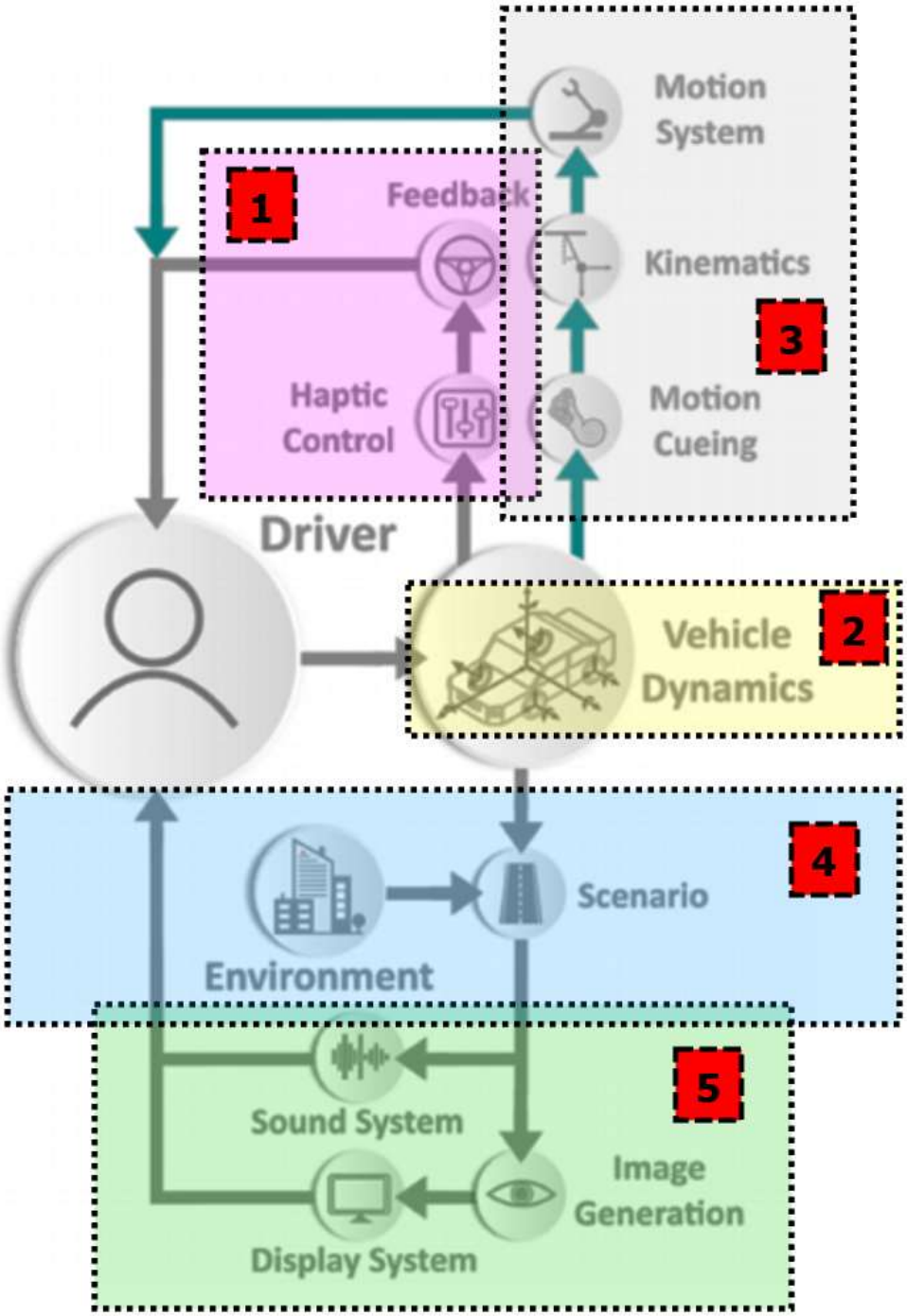
**Reference Figure for PDW**



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**PDW Draft Agenda**

**PDW Introduction (8:00 – 8:30)**

- Who should attend? | Speaker introduction
- Welcome to I/ITSEC 2024 | Agenda overview
- Paired Events
- Certified Modeling & Simulation (CMSP)
- PDW Learning Objectives
- M&S Fundamentals and Terminology
- Vehicle simulation: historical context
- Why MS Excel? (justification)

**"Beyond the Basics" (8:30 – 11:00)**

M&S component - Haptics/Inputs (8:30 – 9:00)

- Human-interface Device (HID)
- Vehicle Control devices
- DirectInput/Xinput
- Input Lag / Latency
- State-space representation

Solution method - Linear algebra

- Definition
- Vectors and Matrices
- Transformations

**Excel Breakout: State-space (matrices)**

M&S component - Vehicle Dynamics (9:00 – 9:30)

- Process schematic (dynamics/cueing)
- Definition
- Ground, flight, marine vehicle equations (notional)

Solution method - Ordinary differential Equations (ODE's)

- ODE's – defined
- Spring-mass-damper (example)
- Numerical solution approaches ($1^{st}$/$2^{nd}$ order)

**Excel Breakout: State-space (ODE's)**

M&S component - Motion Simulation (9:30 – 10:00)

- Cueing Fundamentals
- Acceleration onset (washout)
- Tilt Coordination (G-Tilt)
- Vestibular system basics

Solution approach - Moving averages (low pass filters)

- Low- and High-pass filters
- Moving averages
- Simple Example

**Excel Breakout: Moving averages for (low-pass) G-Tilt**

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M&S component - Virtual Environments (10:00 – 10:30)

- Terrain databases
- Terrain generation
- Static/dynamic scene graphics
- Scenario authoring
- Human Factors

Solution approach - Collision detection

- Definition
- Simple geometric texts
- Bounding Boxes

**Excel Breakout: AV collision demonstration (in 2D)**

M&S component – Displays, Image Generation (IG), and Sound (10:30 – 11:00)

- Screen-based technologies
- Portable technologies (i.e., XR)
- IG fundamentals
- Game Engines
- Sound simulation basics
- Implications in simulation

Solution approach - Goal seeking & optimization

- Scene graph optimization parameters
- GPU settings
- Optimization formulation basics
- Solver tools

**Excel Breakout: FPS optimization for a driving simulation**

**Special topics (11:00 – 11:30)**

- Situational Awareness
- Presence & Immersion
- (the dangers of) Negative Training
- Simulator Maladaptation

**PDW Summary (11:30 – 11:45)**

- "Beyond the Basics" - recap
- Verify PDW Learning Objectives
- Acknowledgements & Bibliography

**PDW Conclusion / Q&A (11:45 – 12:00)**
**TOTAL: 240 mins**