

## Course Content

Course Title (English)	Power Integrity for System-in-Packages
Course Title (Chinese)	系統構裝電源完整度
Credit	3
Instructor	Prof. Ruey-Beei Wu 吳瑞北 教授
Outline	<p>Since the transmission speeds in modern digital systems reach several Gbps and higher, the frequency components of the digital signals cover from DC to several GHz in the microwave spectrum. The power distribution systems (PDS) will encounter various noises due the complex electromagnetic interaction, so called the power integrity. This course will cover the modeling, analysis, simulation, and design for the system-in-package power integrity issues, covering from both the theoretical and practical aspects.</p> <p>With the main themes of parallel plate transmission line theory, simultaneously switching noises, macro-modeling, target impedance design, and real applications examples, the detailed topics include:</p> <ol style="list-style-type: none"><li>1. Fundamental Issues of Power Integrity</li><li>2. Basic Concept of Power Distribution Network</li><li>3. Circuit-Based Modeling for Planes</li><li>4. Discretization-Based Modeling for Planes</li><li>5. Multiple Plane Pairs Modeling</li><li>6. Co-modeling of Transmission Lines and Planes</li><li>7. Applications and Analysis of Co-models</li><li>8. Rational Function Method and Macromodeling</li><li>9. Simulation using Signal Flow Graphs</li></ol>

	<p>10. Applications of PI Modeling</p> <p>11. PI Enhancement by DeCaps and EBG</p> <p>12. SSN Reduction Coding and EMI Mitigation Designs</p>
Goal	<p>Modern digital systems have constructed complex multi-layer multi-conductor structures to connect VRM, PCB, packages, and chips so as to provide power supply to the devices in chips. This power distribution system will exhibit the power integrity issues of ever-increasing noises due to the parallel-plate resonance in PCB, coupling between parallel plates and transmission lines, and so on as the operating speed becomes higher. Students will learn from basic electromagnetic theory to board-package-chip co-simulation techniques, and design concepts to improve the power integrity for the power distribution systems (PDS) in modern digital systems.</p>
English Teaching	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Teaching Material	<input checked="" type="checkbox"/> English <input type="checkbox"/> Chinese