SYNOPSYS®

DATASHEET

ImSym—Imaging System Simulator

End-to-End Imaging System Simulation for Unprecedented Efficiency and Accuracy

Features at a Glance

- Industry-first system-level imaging design platform
- Design cycles accelerated by up to 60x
- Results driven by the industry-proven accuracy of CODE V and LightTools
- Leading-edge interface for an exceptional customer experience
- Intuitive, integrated workflow that guides you through design and analysis
- Image generation capability for product sales and marketing support
- Python programming language interface for automating ImSym processes
- Custom ISP capability using Python scripted routines

In the current camera development landscape, vendors rely heavily on real prototypes to assess the image quality of any camera they design, manufacture, and assemble. This traditional approach leads to long manufacturing cycles, suboptimal yields, and sometimes even costly redesigns. With no efficient way to simulate the image quality of a camera, the development process is cumbersome and time consuming.

ImSym—Imaging System Simulator addresses these challenges by providing an end-to-end model of an imaging system, including lenses, sensors, and image signal processors (ISPs) before it is sent for manufacturing. This innovative simulation methodology helps design teams collaborate more effectively and bring their cutting-edge imaging products to market faster. With a verifiable level of accuracy that eliminates the need for physical prototypes, ImSym simulations can directly translate into production-ready designs. By integrating all aspects of the imaging chain into one cohesive platform, ImSym ensures that every element is optimized for peak performance, reducing the risk of unforeseen issues during later stages of development.

Key Features

Comprehensive Imaging Chain Simulation

ImSym guides you through the entire imaging chain of digital optics systems:

- **Scene Capture:** Begin by capturing the subject or environment being imaged. ImSym allows you to simulate various lighting conditions and scene complexities to ensure robust performance across different scenarios.
- **Optics:** Manipulate and focus light toward the detector array. Advanced optical modeling tools enable you to precisely design and optimize lens systems to achieve the desired image quality.
- **Detector Array:** Convert incoming photons into an initial electronic signal. Simulate various sensor technologies and configurations to find the best fit for your application.
- **Readout Electronics:** Further convert the accumulated electron count into digital counts to simulate analog-to-digital converter quantization effects.
- **Image Signal Processing:** Apply algorithms to produce a high-quality final image. Test and refine image processing algorithms in a simulated environment to ensure they perform optimally in real-world conditions.

Streamline Collaboration

Engineers can model imaging systems within a single, intuitive environment. This centralized approach eliminates the need for disparate tools and fosters a cohesive development process. The shared environment facilitates seamless team collaboration through shared models and simulations. Real-time updates and version control ensure that all team members are working with the latest data.

Increase Efficiency

Software modeling reduces development time from weeks to days and from hours to minutes. The powerful ImSym simulation engine accelerates the evaluation and iteration process, allowing for rapid prototyping and development. With ImSym, achieve up to 60 times more efficiency compared to traditional methods. This significant increase in efficiency translates to faster time-to-market and reduced development costs.

Generate Realistic, System-Level Simulations

In ImSym, engineers can evaluate how changes to one component affect the entire system. This holistic approach ensures that all interactions and dependencies are considered, leading to more reliable and optimized designs.

High-fidelity simulations translate directly into production, reducing the need for physical prototypes. By minimizing the reliance on physical prototypes, ImSym helps reduce material waste and environmental impact.

User-Friendly Interface

ImSym guides you through each step of the imaging chain with an intuitive interface and simplifies the complex process of digital optics system design. Even if you have limited experience in optical system design, you can quickly become proficient with ImSym. Comprehensive tutorials and support resources are available to assist you at every stage of the design process.

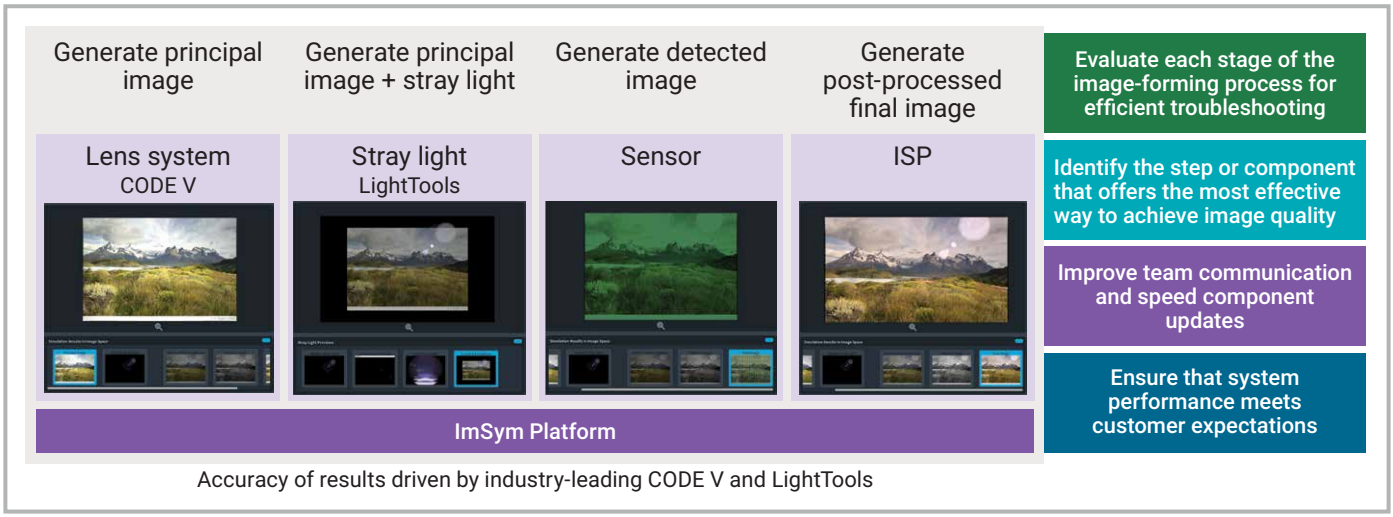

Figure 1: ImSym accelerates design cycles

Detailed Workflow

Step 1: Specify Inputs

You can choose the scene for the image, specify relative scene radiance, add stray light sources, set detector parameters, and input CODE V 2D Image Simulation (IMS) and LightTools model parameters. This ensures that camera system performance meets customer expectations, quickly identifies the most effective steps to achieve image quality and improves team communication.

Step 2: Generate Principal (Aerial) Image

Using the CODE V IMS feature, you can calculate the principal image, utilize the enhanced, faster IMS available in CODE V 2024.03, and display and output the principal image. This step allows optical designers to potentially save money by not over-designing expensive lenses and to efficiently visualize the lens in 3D view.

Step 3: Generate Stray Light Eigenfunctions

You can set up the model in LightTools, add preliminary barrels and spacers to a lens, and generate stray light Eigenfunctions. This helps minimize scattered and stray light in the image and accurately identify the most disruptive sources of stray light.

Step 4: Generate Stray Light

ImSym and the stray light Eigenfunctions can be used to generate additive and scene stray light. This minimizes scattered and stray light in the image, ensuring that you obtain the desired image quality.

Step 5: Combine Focal Plane Flux

You can show the CODE V IMS output file, display the results of the additive and scene stray light computation, and combine these with the principal image. This accurately evaluates the image, including stray light effects, that will be delivered to the detector.

Step 6: Detect Input Flux

Model the detector quantum efficiency, spectral filter transmittances, and generate sensor noise. Combine the sensor response with sensor noise and output the result to ensure the detector's performance meets the required standards.

Step 7: Process the Detected Image

Optionally generate sensor calibration data, demosaic the image, apply blurring and sharpening effects, and run ISP routines. This allows you to quickly simulate ISP performance and determine the effects of specific parameters.

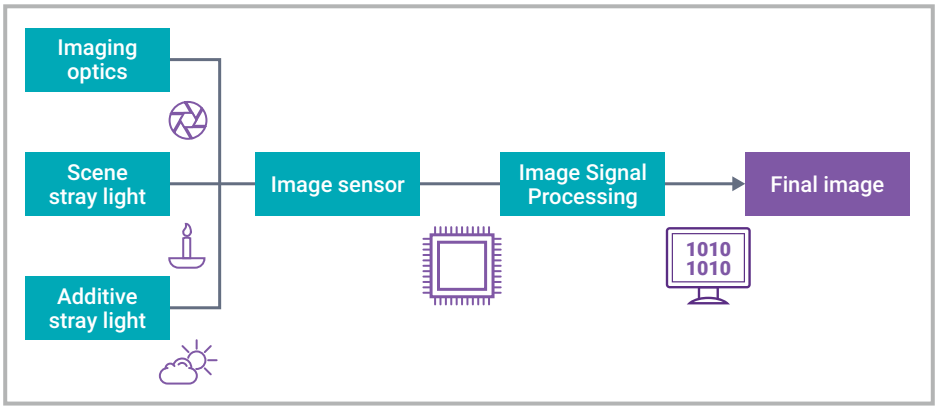

Figure 2: The simulated image from the imaging optics is combined with stray light effects from the scene and from an external source, and the combined irradiance is processed by the image sensor model and post processed using built-in or custom Image Signal Processing routines

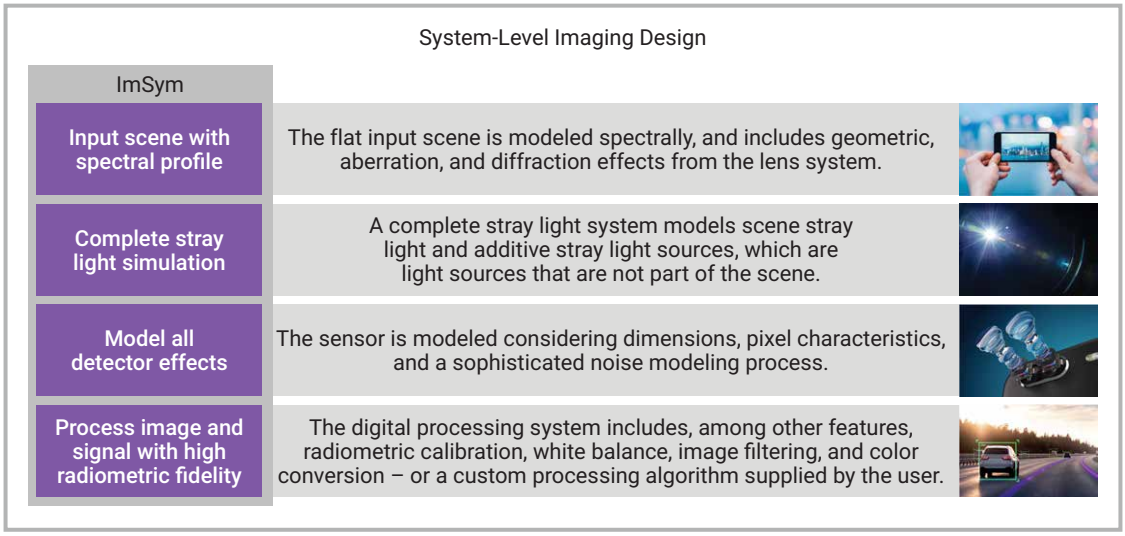

Figure 3: ImSym guides you through the entire imaging chain of digital optics systems with a comprehensive imaging chain simulation

The ImSym Advantage

ImSym is set to revolutionize camera system development as the industry's first complete, system-level imaging design platform. Driven by the power of CODE V and LightTools, ImSym provides unparalleled capabilities to analyze and optimize optical imaging systems. By offering virtual image modeling, ImSym drastically reduces product development time by up to 60 times compared to traditional methods. The accuracy of results, ensured by industry-proven CODE V and LightTools, allows for precise, production-ready simulations.

With ImSym, engineers can directly model and adjust lenses, sensors, and ISPs based on comprehensive image quality analysis—all within a single, intuitive environment. This cutting-edge platform can ensure that your next great imaging product hits the market faster and with incomparable quality, allowing you to confidently move from concept to production.

For more information about ImSym, email optics@synopsys.com.