

NxFracture – Fracturing Software for Semiconductor Photomasks

NxFracture is a high performance and versatile fracturing and data preparation software for Photomask Writing, Inspection, and Electron Beam Direct Write systems.

Challenging CD requirements at advanced technology nodes coupled with ever increasing Mask Data Volume and exorbitant Mask Writing Time demand Fracturing Software with higher Quality of Results (QoR) and reduced Turnaround time.

NxFracture's advanced algorithms ensure the best fracturing QoR in terms of Shot Count, Sliver Control, Figure Count, CD/gate split minimization, Uniformity of Fracturing and Output File Size. NxFracture enables users to optimize QoR across multiple parameters of interest simultaneously. NxFracture's Shot-aware fracturing algorithm directly minimizes shot count in the fractured output to reduce mask write time.

Designed for distributed environments, NxFracture automatically makes optimal use of multiple CPUs and cores thus reducing the fracturing turn around time and providing unlimited scalability. NxFracture accepts industry standard Layout and Mask file formats as input and generates optimized fractured output for a wide range of Mask formats. NxFracture is based on SoftJin's widely deployed Nirmaan Polygonal Data Processing Platform with the industry's fastest data import and export capabilities. NxFracture Software Suite includes Boolean, Sizing and other Geometric operations needed for Mask Data Preparation.

Key Benefits

Shot-aware Fracturing

- Shot-aware algorithm of NxFracture reduces the number of shots directly instead of trying to reduce shots through reducing the number of figures
- Directly results in lower Mask Writing Time

Highest Quality of Fracturing Results

- Fracturing uniformity increases CD uniformity
- Enables user to optimize QoR across multiple parameters simultaneously

Excellent throughput

- Leverages distributed computing as well as multi-core infrastructure
- Unlimited data handling capacity

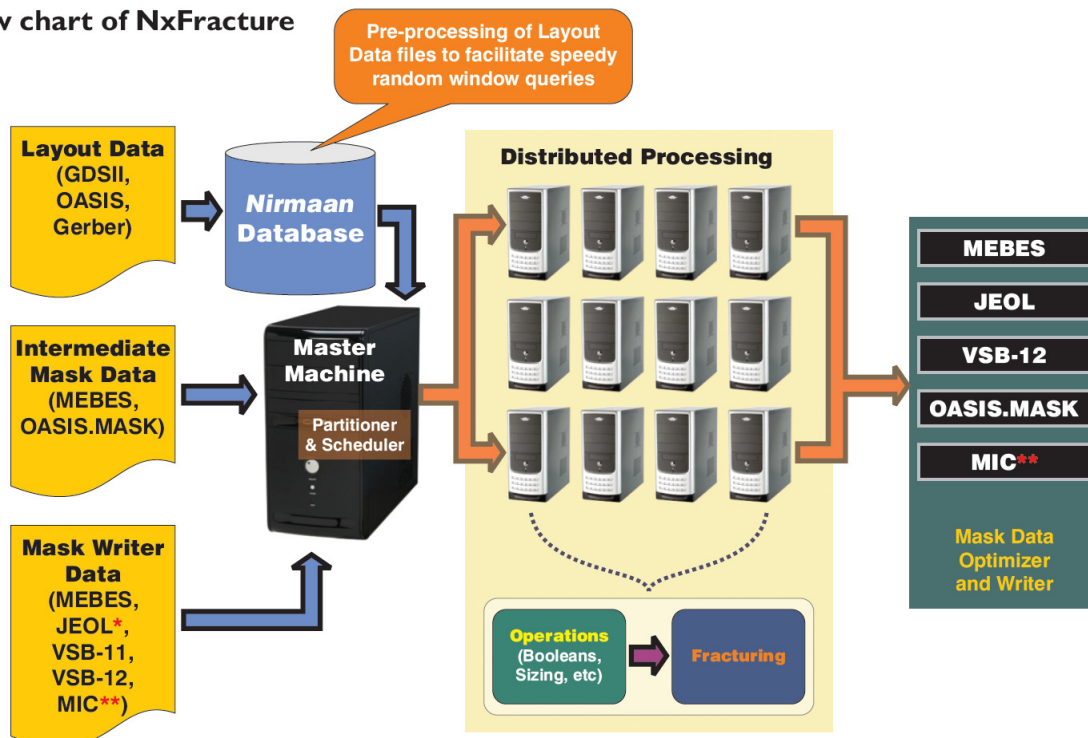
Format specific optimizations

- Fracturing specific to the characteristics of the output Mask Format

Excellent price to performance ratio

- Reduces MDP software cost

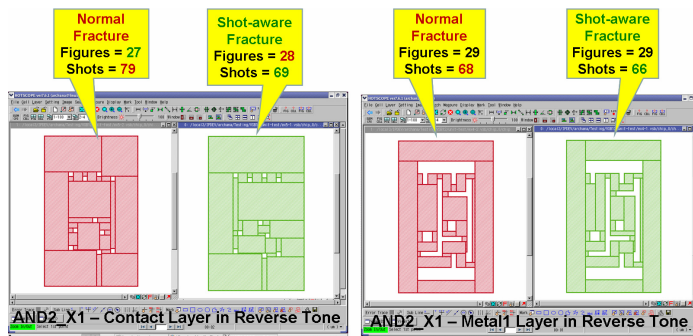
Flow chart of NxFracture



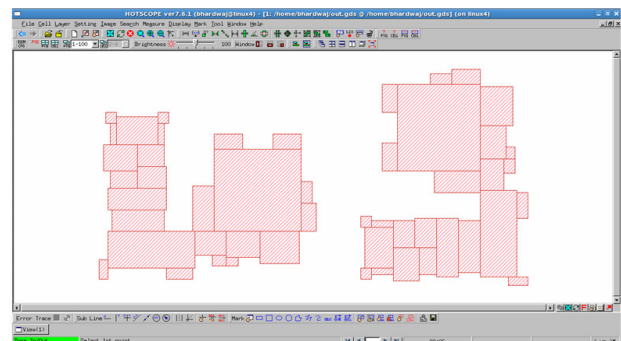
*If JEOL data is given as input to NxFracture, the output could only be JEOL
** MIC is the data format supported by Micronic's exposure machine

Key Product Features

- **High quality fractured output**
 - Shot-aware fracturing algorithm directly minimizes shot count in the fractured output to reduce mask write time
 - Minimizes the number of figures and generates congruent figures in the fractured output to reduce the output file size
 - Avoidance of slivers to increase the fidelity of patterns written on the mask
 - Avoids CD/gate splitting for CD conformity on the mask
 - Guarantees Uniform fracturing of polygons irrespective of orientation for better CD uniformity
 - Generates shots with aspect ratio close to one to facilitate uniform energy/dose distribution over the printed patterns
 - Minimizes the number of thin slivers if slivers are unavoidable.
 - Tries to avoid long slivers if slivers are unavoidable.
 - Minimizes all angle edge splits to reduce shot count and Line Edge Roughness (LER)
- **Distributed computing support**
 - Efficient use of distributed processing and multi-core architecture for better throughput
 - Intelligent partitioning and distribution of data across multiple cores and multiple CPUs
 - Customizable attributes in the user parameter file enabling user to control the distributed environment
- **Large Data Handling**
 - Unlimited data handling capacity, capable of handling files of any size
 - Handles files of any hierarchy type (such as flat, hierarchical or post-OPC hierarchical)
 - Efficient and versatile geometric engine to support all-angle as well as positive and reverse tone data
- **Interfaces**
 - TCL based user scripting interface enables easy customization, configuration and integration
 - Integrated with industry leading layout and mask data viewer
 - As part of SoftJin's NxMDP tool-suite, NxFracture has close integration with other tools including NxCompare (layout / mask data equivalence checker and other Boolean / geometrical operations), NxStats (for analyzing QoR of fractured data) and NxMRC (mask rule checker) tools
- **Advanced User controllable parameters**
 - User can assign priorities / weights to various parameters to control QoR
 - Identification criterion for CDs and controlling the avoidance of CD splits
- **Advanced operations on Input layout data**
 - Built in Boolean functions on the input data layers of the layout file
 - Support for positive and reverse tone fracturing
 - Scaling, Rotation, Translation, Mirroring and Tone Reversal options on the input layers
 - Full chip, Window-specific, Cell-specific, and Layer specific options to filter out the input layers for fracturing
- **Supports Layout and Mask data formats**
 - **Input design layout formats** - GDSII, OASIS and Gerber as input layout data
 - **Input intermediate layout/mask formats** – MEBES, MEBES Job deck, OASIS.MASK, MALY
 - **Input mask formats** - JEOL, JEOL Job deck, VSB-11, VSB-12 and MIC. Already fractured data in these mask formats can be re-fractured for better quality
 - **Output mask formats** - MEBES, JEOL, VSB-12, OASIS.MASK and MIC. Support for generating VSB-11 to be available shortly.
 - Format specific optimization for each of the mask formats while fracturing the data
- **Mask Inspection and EBDW Application**
 - NxFracture can generate mask data (in MEBES or OASIS.MASK format) suited for Die-to-Database mask inspection. Characteristics of mask data for Die-to-Database mask inspection are different from those of fractured data for mask-writing.
 - For Data Preparation for E-Beam Direct Write Systems, NxFracture can be used to generate
 - Compressed bitmap data or
 - Intermediate trapezoidal data (efficient for conversion into exposure bitmap data in real-time)
- **Backed by SoftJin's customized software development and integration services to meet specific customization needs and customizations for Equipment vendors and end-customers**



Shot-aware Fracturing algorithm directly attempts shot reduction



Guaranteed Uniform Fracturing irrespective of orientation of polygons

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