Generating Scanning Electron Microscopic Images from Optical Designs using image to image translation with Conditional GANs.

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Motivation
Detection and classification of defects during semiconductor manufacturing is critical in enhancing the production yield of electronic chips. Scanning Electron Microscope (SEM) tools are used to identify these defects by scanning the silicon wafers in each manufacturing step. In this work, a new methodology is implemented to enhance the defect detection by artificially generating SEM images from optical designs of the electronic chip using conditional GANs[1]. These images serve as reference images to the original images obtained from SEM tools to identify the defects.

Network Architecture

Data Set

Data Preparation: In order to train GAN networks, the data was prepared by obtaining optical designs, rendering them to binary images and grabbing its corresponding SEM images from the Semiconductor wafers. The optical design images were aligned to SEM images by using image correlation. The SEM images were downsampled to image size of 256x256, while the design images were upsampled to the same size. These aligned image pairs form the data set for the GAN network. Fig 1a shows an example of these aligned image pair.

Data set: 500 aligned pair images
Training 400, Validation 100

Data Augmentation:
Image flipping, Random cropping

Video @ https://youtu.be/usaufGysvQ

Results

Optical Design

Grabbed SEM image

Fig 1.

Generated image

Fig 2.

Conclusion
Image to image translation via conditional GANs is effective in learning mapping from optical design to real world SEM images.

Fix potential application in simulating chip designs and detecting defects in chip manufacturing

Future Work
Fix undesirable aberrations caused in the Generated Image

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References