Euler–Bernoulli bending theory applied to high NA EUV dense line-space patterning to characterize the line wiggling

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As extreme ultraviolet (EUV) lithography advances toward high numerical aperture (NA) systems and sub-10 nm feature sizes, maintaining pattern fidelity becomes increasingly challenging. One critical issue is line wiggling (LW), a lateral distortion of dense line-space patterns that emerges after development and etching. This study applies Euler–Bernoulli beam bending theory to model the mechanical behaviour of resist lines, revealing how resist properties, development conditions, and film stack architecture influence LW formation. Key drivers include the aspect ratio of the lines, material stiffness (Young's modulus), and etching-induced forces. Our findings underscore the importance of a holistic approach optimizing resist mechanics, stack design, and etch strategies to suppress LW and prevent line collapse, which is essential for achieving high yield in next generation EUV patterning.