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# Analysing the Stress and Loading System Stiffness at Face Burst Source Regions through Numerical Modelling

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7 November 2013

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# Extreme Stress Problem

- **Conventional boundary element techniques produce extreme stress values close to the excavation due to the singular nature of the displacement discontinuity (DD) kernels.**
- **These stress values need to be interpreted for face burst and pillar stability assessment.**
- **The proposed method minimizes the extreme stress problem by tapering the DD distribution to zero along the boundary of the excavation.**

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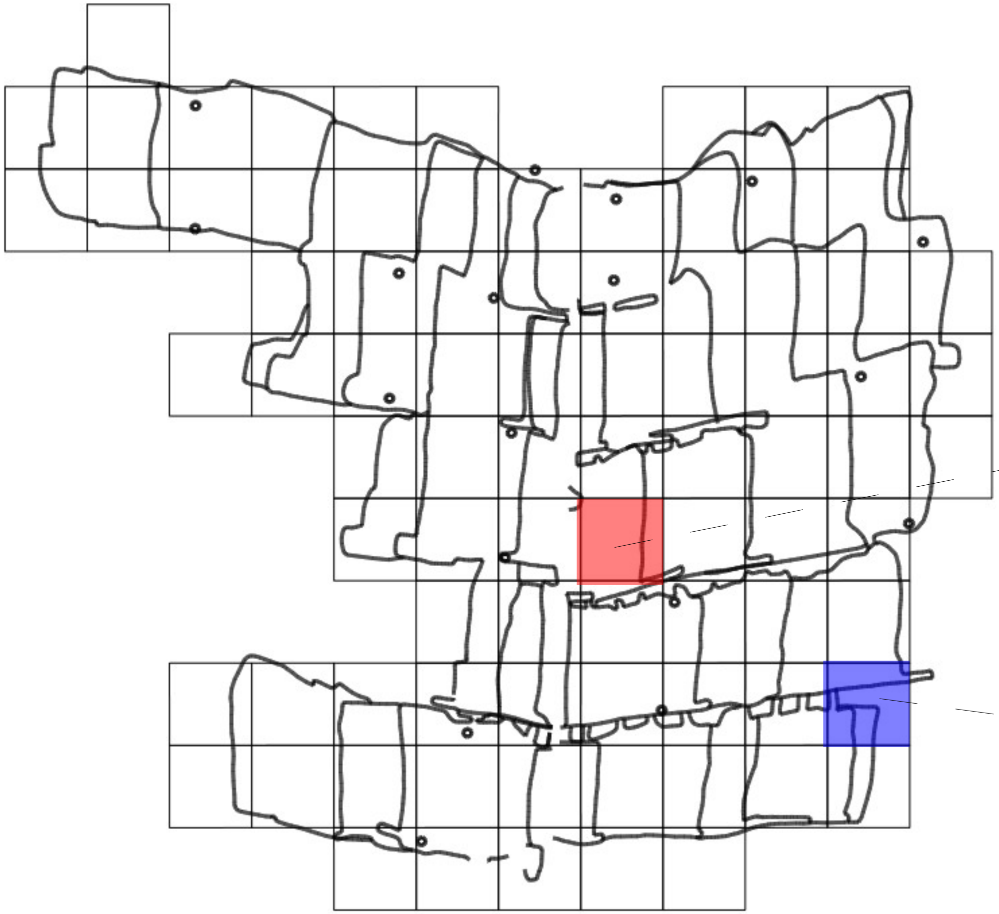
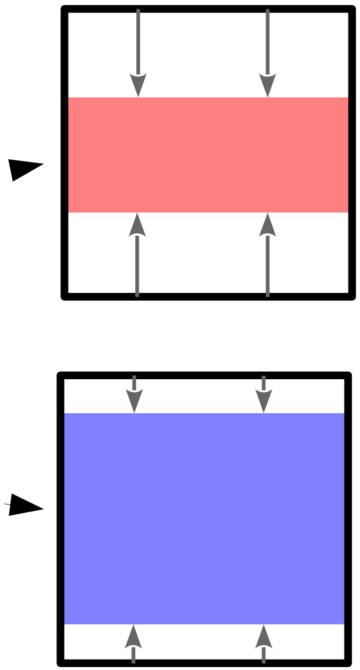
# DD Elements: Implementation



**DD$^{\perp}$ ≡ Closure**



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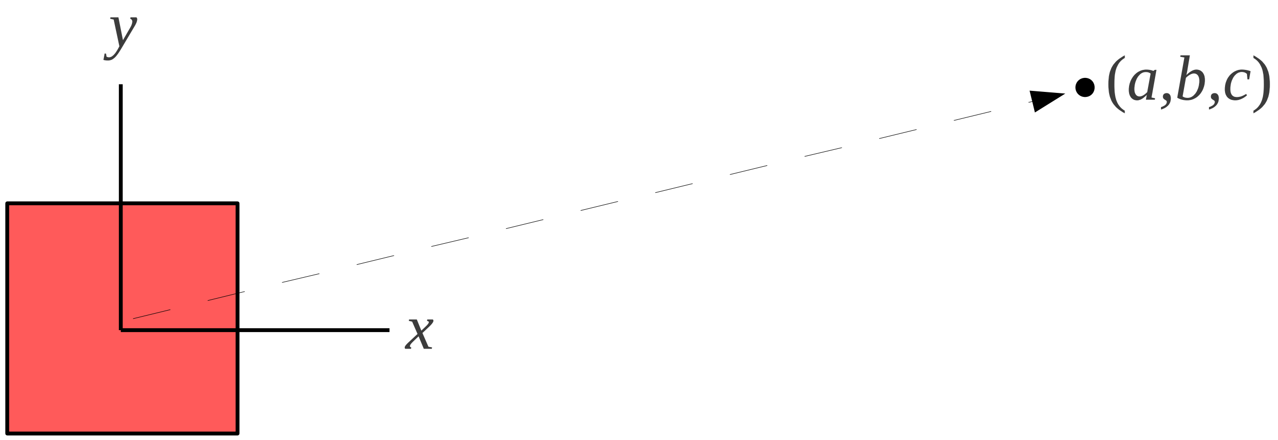
# DD Elements: Influence Integral




$$\iint g(x,y)G(a,b,c,x,y)\,dxdy$$

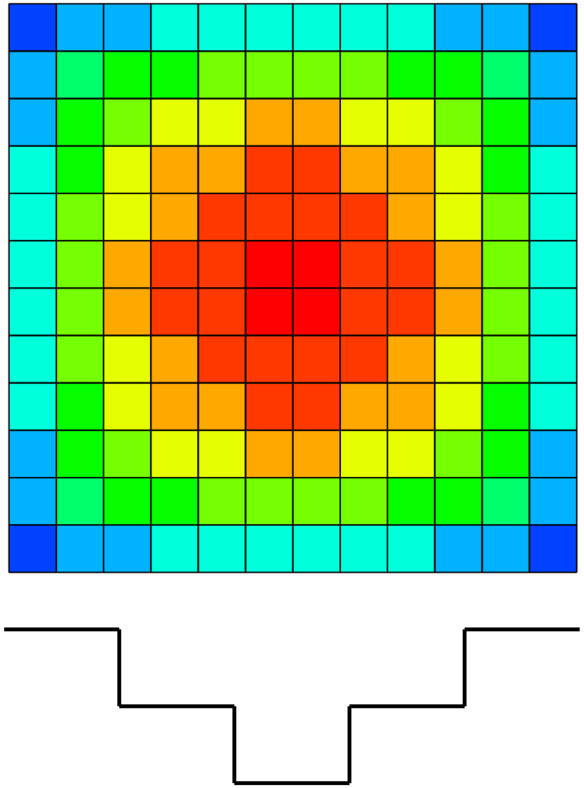
**Distribution Function:** $g(x,y)$

**Kernel Function:** $G(a,b,c,x,y)$

# DD Elements: Distribution Functions

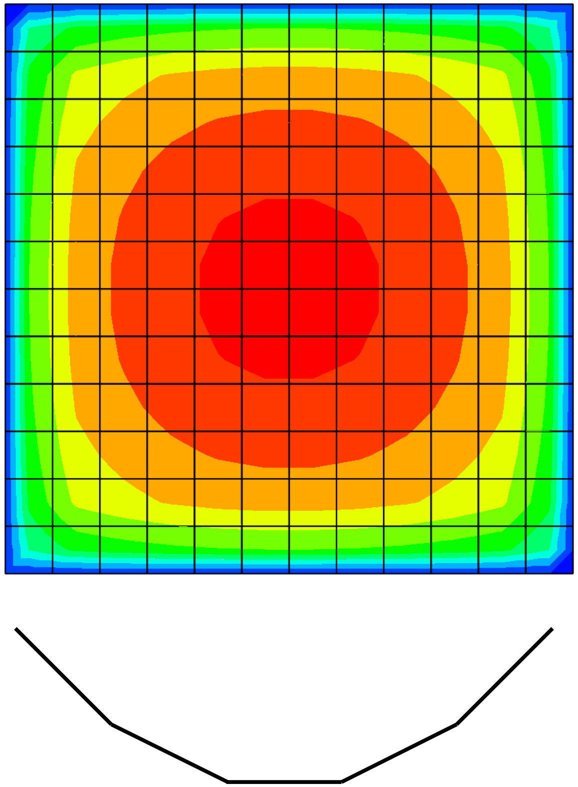
**Constant**

$$g(x,y)=1$$



**Bilinear**

$$g(x,y)=1+Ax+By+Cxy$$



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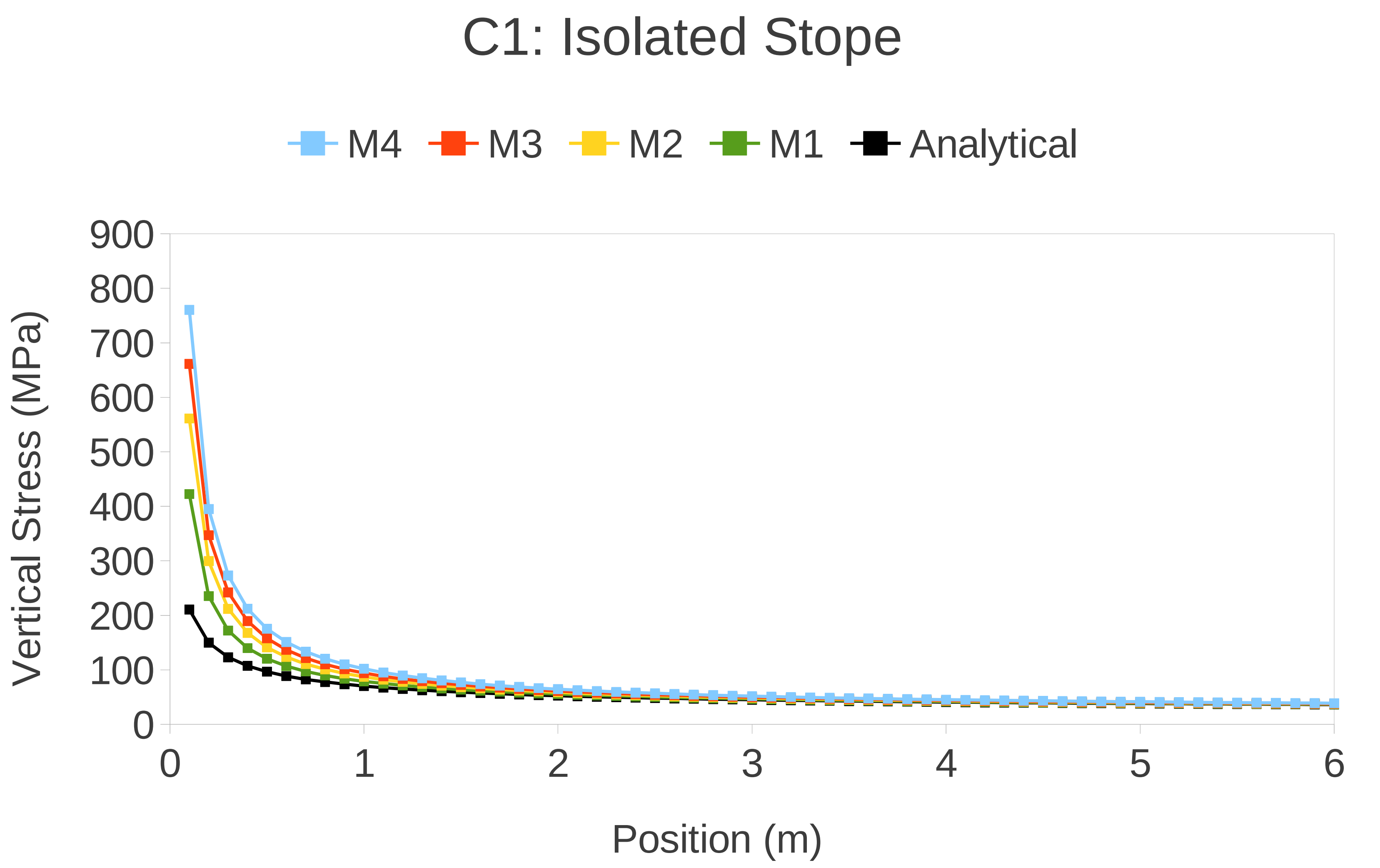
# Induced Stress: Constant Elements



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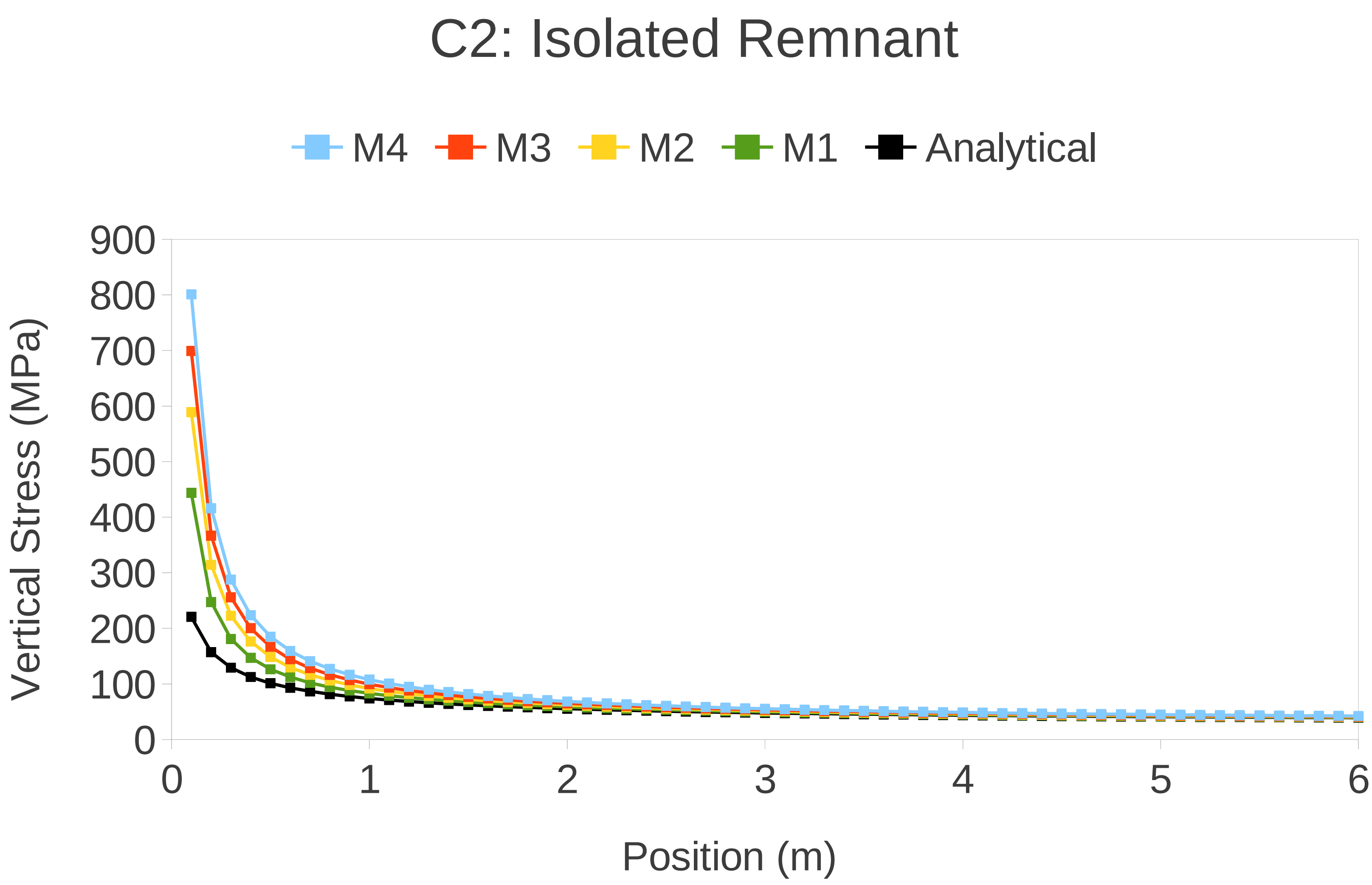
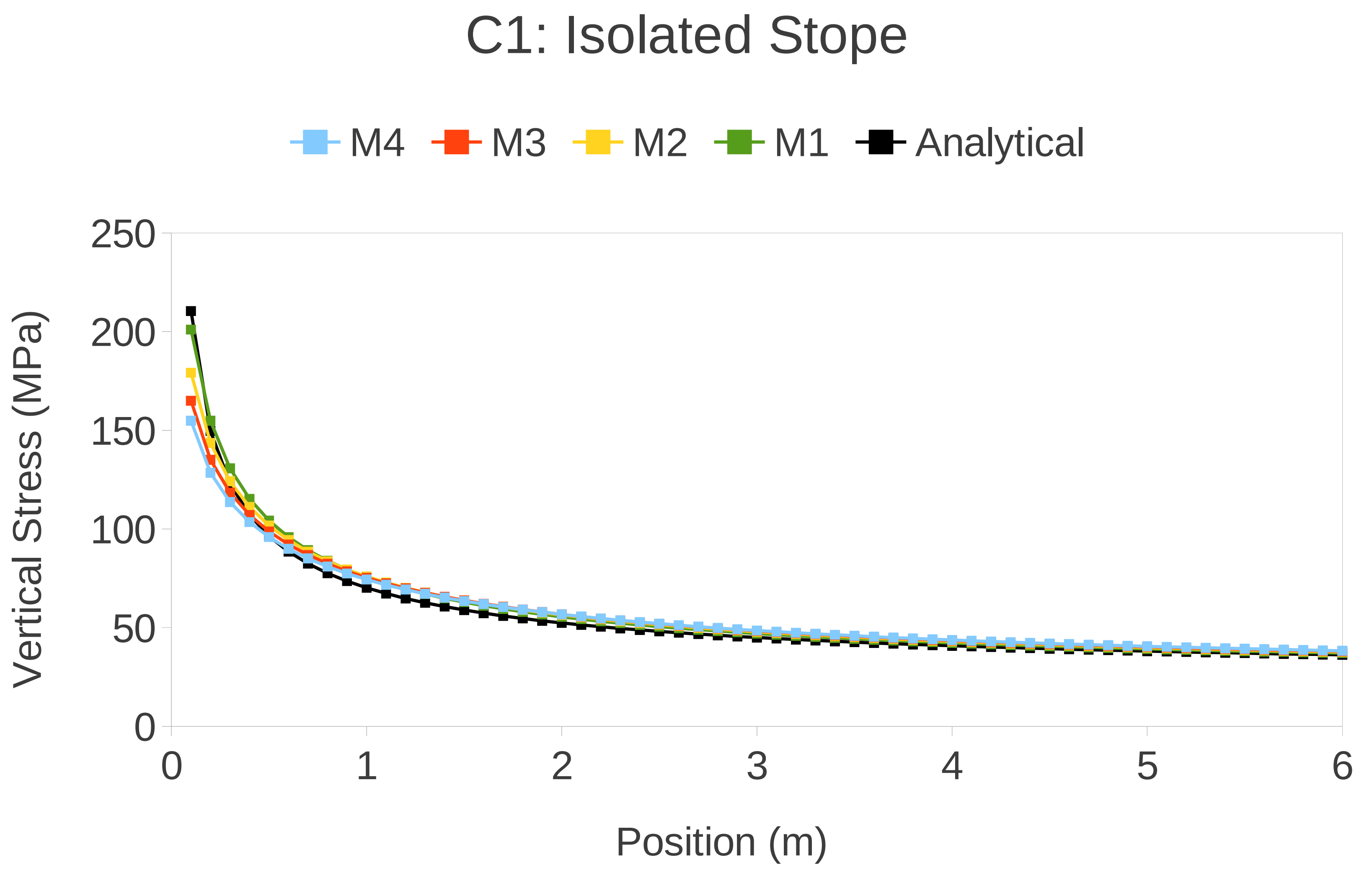
# Induced Stress: Constant Elements



# Induced Stress: Bilinear Elements



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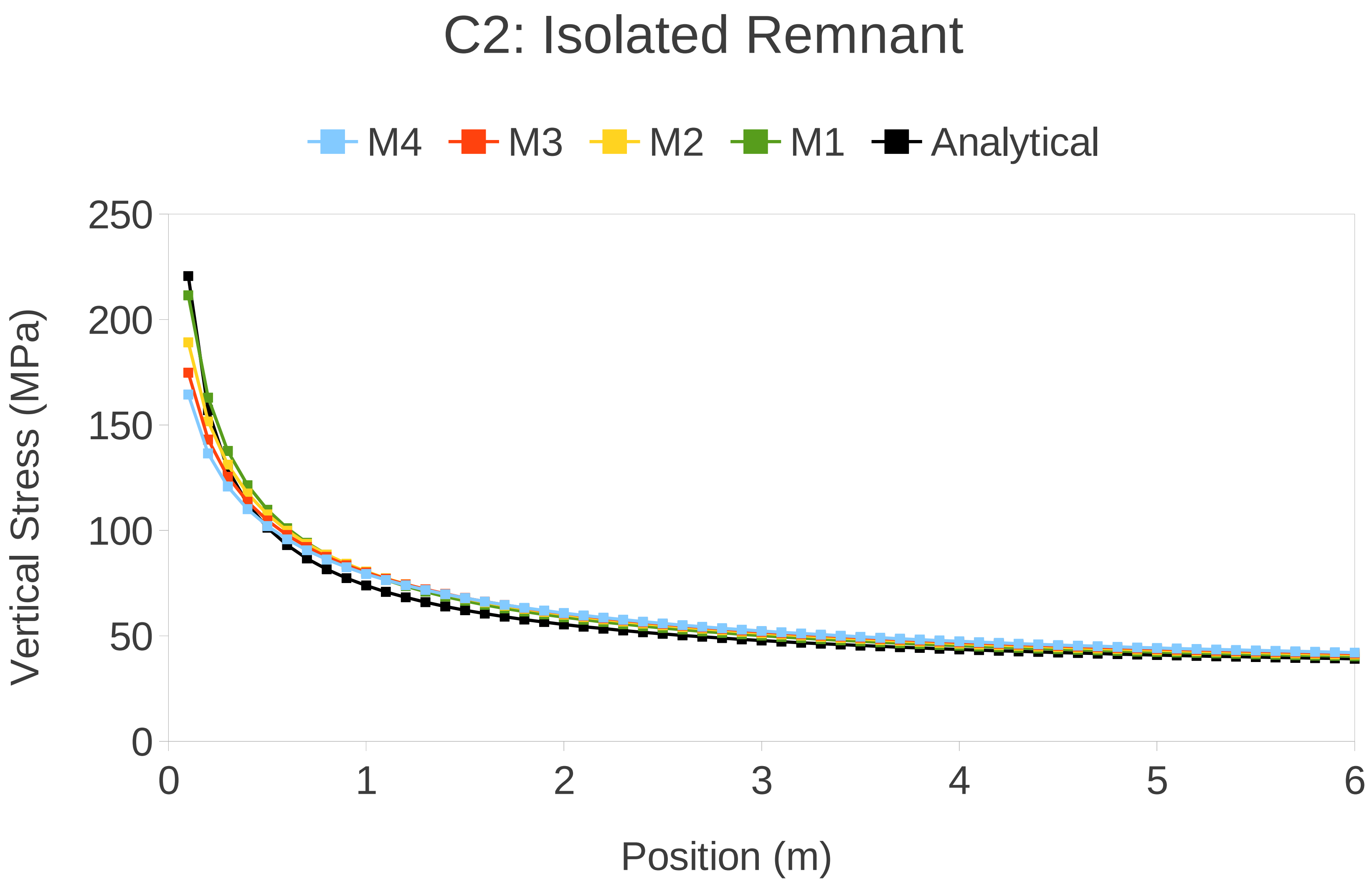
# Induced Stress: Bilinear Elements



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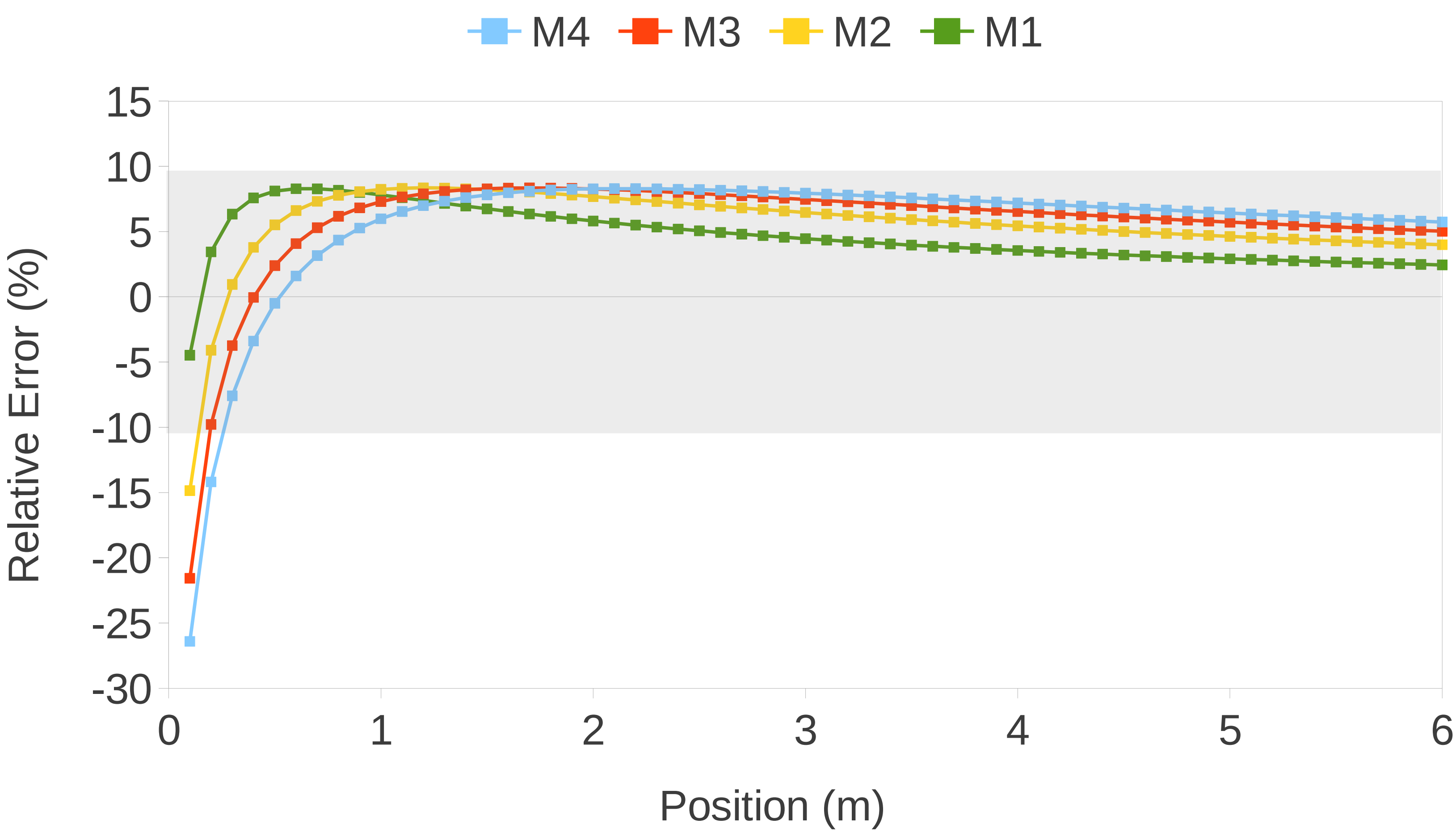
# Relative Error: Bilinear Elements

C1: Isolated Stope



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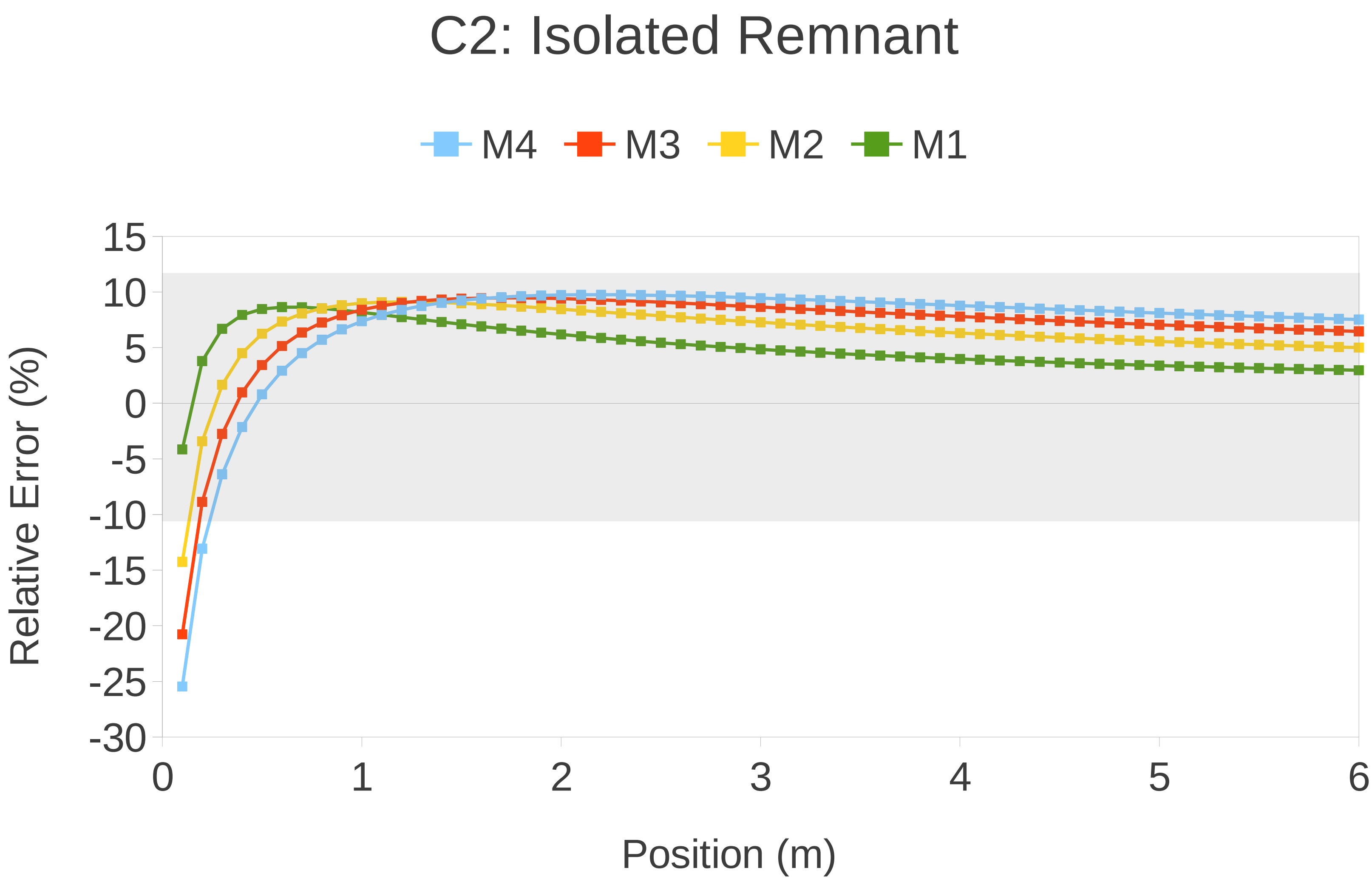
# Relative Error: Bilinear Elements



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# Conclusion

- **The introduction of bilinear displacement discontinuity (DD) elements improved the accuracy of stress calculations close to the excavation**
- **A relative error of less than 10% is expected when a result grid resolution equal to a tenth of the DD element size is used.**
- **These results allow meaningful interpretation of numerical stresses close to the excavation for face burst and pillar stability assessment.**