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## Fringe field maps for transverse gradient bending magnets with curved poles

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We present second-order fringe maps for gradient dipoles whose poles are curved to follow the reference orbit. While some of the results have been previously found, we find new contributions including soft-edge linear terms that can be significant for gradient dipoles. In addition, we depart from previous works by writing all soft-edge corrections in terms of integrals along the particle trajectory; this appears to be required for dipoles with strong transverse gradients. We have added the fringe model to the CSBEND element in the tracking code ELEGANT\*, and we compare the fringe map predictions to those of field-map tracking for several transverse gradient dipoles used in the APS-Upgrade.

### Footnotes

- M. Borland, APS LS-287 (2000)

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