

# Extension and Evaluation of Pseudo - Linear Zoeppritz Approximations

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## ABSTRACT

The Zoeppritz coefficients describe seismic reflection and transmission properties of idealized solid-solid interfaces. The Aki-Richards approximations linearize these coefficients in terms of elastic property contrasts across the interface. Such expressions, especially for the P-P and P-S reflections, are the starting point for most AVO (amplitude variation with offset) analysis of seismic data. We have previously introduced the idea of an Optimal Zoeppritz Approximation, which is designed to be both accurate and simple. We have shown that it is naturally expressed in a form that is pseudo-linear, analogous to the form of the Aki-Richards approximation. We have proposed that these forms would be of potential value in AVO studies.

In this report we review our earlier results and present two extensions. In the first we have extended the range of validity of the pseudo-linear approximation for the P-P reflection coefficient. In the previous form it was accurate only up to the critical point, which is often adequate for seismic applications. However, attempts to derive density contrasts from AVO require large-offset surveys, and this increases the likelihood of dealing with post-critical data. Accordingly we have developed an approximation which is somewhat more complex, but which is reasonably accurate for much of the post-critical regime. In the second extension we demonstrate that the exact Zoeppritz expression itself can be expressed in a pseudo-linear form, which may be useful in theoretical and/or practical studies. Finally, we use numerical tests to assess the potential practicality and accuracy of pseudo-linear approximations in AVO applications.