PP and PS reflection and transmission coefficients in anelastic media: the anomalous case

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Summary

Using the derivation of reflection and transmission coefficients at the interface between two elastic given in Aki and Richards (1980) as a starting point, modified coefficients may be obtained for the case of two anelastic media in welded contact at a similar (plane) boundary. The anelastic equivalents of two elastic velocity distributions are considered for incidence on the plane boundary separating the two medium. Figures showing the plots of amplitude and phase as well as real and imaginary parts of the four coefficients P_1P_1, P_1P_2, P_1S_1 and P_1S_2 are produced with the results from the elastic case included in all of the plots.

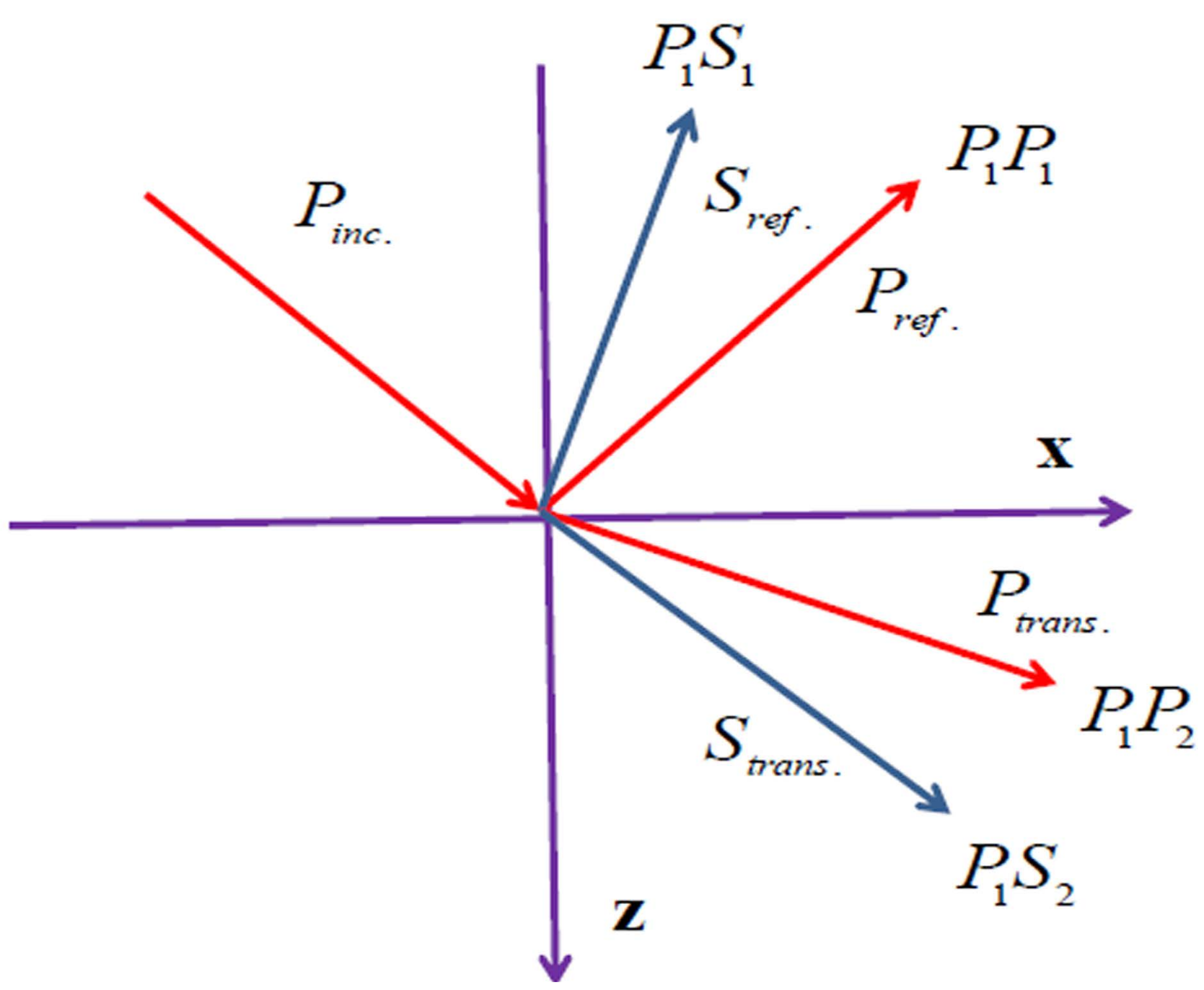

Fig.1. A schematic of a *P* – wave incident from the upper medium on an interface between two media and the resulting wave types that arise. The subscripts "*inc.*", "*ref.*" and "*trans.*" refer to incident, reflected and transmitted modes, respectively.

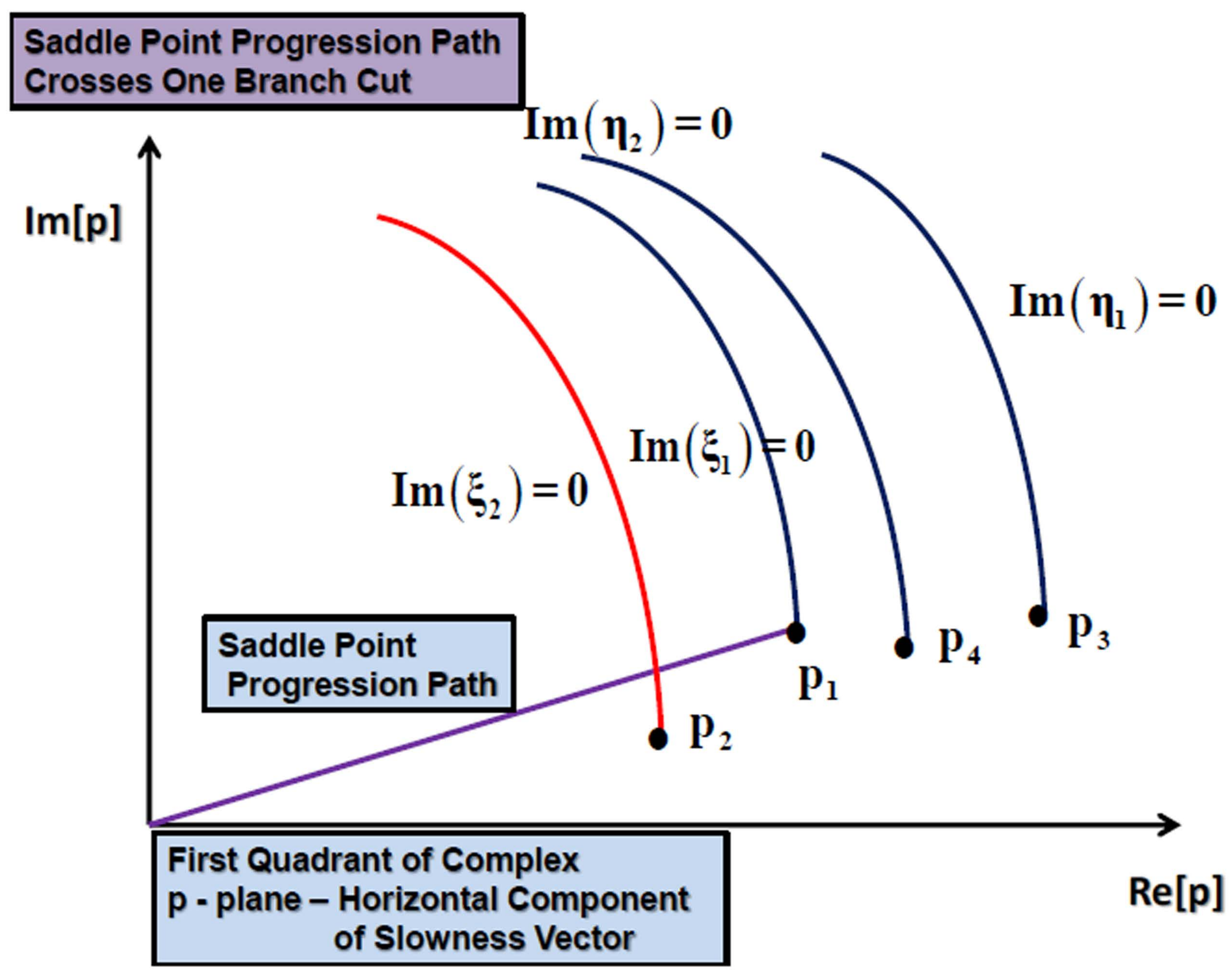

Fig.2. A schematic of the first quadrant of the complex *p* – plane (horizontal component of the slowness vector). The *saddle point progression path* is the values that the incident *P* – wave may have corresponding to the elastic case of $[0 \le \sin\theta/\alpha_1 \le 1;\ 0 \le \theta \le \pi/2]$

Layer	α	β	ρ	Q_P	Q_S
1	1.0	0.57	1.0	10.0	20.0
2	1.5	0.82	1.0	15.0	22.0

Table. Medium parameters for the model. The real valued velocities (α and β) have dimensions of *km/s*, density has the dimensions of *gm/cc* and the Q are dimensionless.

***Anomalous* requires that:**

(1). $\alpha_2 > \alpha_1$

(2). $Q_{P_1} < Q_{P_2}$

The anomalous behavior occurs when the saddle point progression path crosses the branch cut associated with

$$p = p_2$$

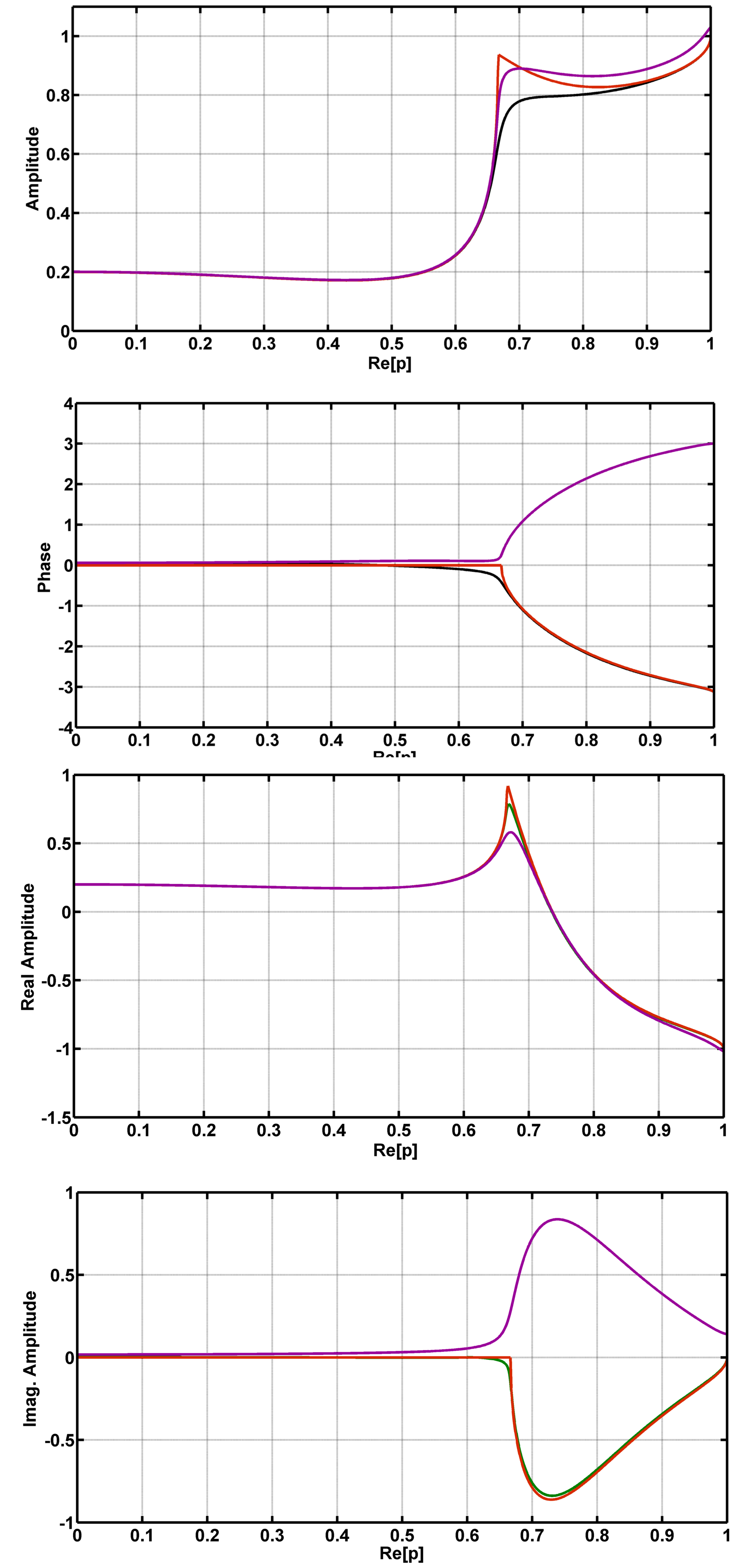

Fig.3. P1P1 reflection coefficient. The upper two panels show the amplitude and phase plotted versus the real value of horizontal slowness. **The bottom two panels show the real and imaginary parts plotted versus the same quantity. Red indicates the reference elastic case. Purple indicates the anomalous case before corrections.**