# A hybrid approach to elastic reverse time migration (ERTM): exploring acoustic schemes in ERTM

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**The elastic reverse time migration (ERTM) algorithm has high relevance in seismic imaging and its implementation has increased over time, both in industry and academic projects. The addition of elastic effects (s-wave information) in seismic modeling has the ability to bring new perspectives and valuable details to the processed image. Moreover, the ERTM images have more quality compared to only acoustic approximations to the ERTM. However, acoustic approximation is used for elastic problems because acoustic RTM is faster than elastic RTM and also requires less memory (fast and cheap). In this context, our work proposes a hybrid scheme that partially explores acoustic approximations in elastic RTM. For only ERTM images of converted p-waves (PP image), we generate two types of images based on acoustic-elastic and elastic-acoustic approximations. Since the RTM algorithm has at least two seismic modeling schemes, one for forward propagation and one for backward propagation, we use only an acoustic scheme on the source-side to model the propagation of the source wavefield (pressure wavefield) and an elastic scheme on the receiver-side to model the propagation of the receiver wavefield using the divergence operator on the particle velocity fields to obtain the pressure wavefield. Therefore, the correlation between these pressure wavefields is established to generate the acoustic-elastic images. In the case of the elastic-acoustic images, we use the elastic scheme on the source-side and the acoustic scheme on the receiver-side, which is equivalent to the acoustic-elastic scheme. The main advantage of this approach is the partial preservation of the elastic component on the RTM image as well as the exploration of the speed of the acoustic algorithms. The methodology of the work consists in comparing the acoustic-elastic and the elastic-acoustic RTM with only acoustic approximations and the elastic RTM, analyzing the processing time and the quality of the obtained images. Results are obtained when performing RTM migration in 2D synthetic models and using synthetic elastic seismic data. Our results show that the hybrid RTM is able to obtain a better image than the pure acoustic approximations for RTM and is faster than elastic RTM.**