Introduction and recording time. second, we will define

Introduction Real and synthetic data verifies the wavefieldtransformation method described here converts surface waves on a shot gatherdirectly into images of multi-mode dispersion curves. Pre-existingmulti-channel processing methods require preparation of a shot gather withexceptionally large number of traces that cover wide range ofsource-to-receiver offsets for a reliable separation of different modes. This method constructs high-resolution images ofdispersion curves with relatively small number of traces. The extraction of dispersionproperties of surface waves can be used to find many useful applications ingeophysical (Park et al., 1996; 1998) and geotechnical (Stokoe et al., 1994)engineering projects.

Therefore, Numerical simulation of surface wavepropagation has been made using finite difference staggered-grid method inMATLAB. This program is used to create a wave propagation using three models: three layers model, stepping-up model, and low velocity layer model to get thesnapshot result and synthetic seismic data. Method We develop a wavefield transformation method thatprovides images of dispersion curves directly from the recorded wavefields of asingle shot gather. With this method, different modes are separated with higherresolution even if the shot gather consists of a relatively small number oftraces collected over a limited offset range. In this research, we createcreate a wave propagation using three models: three layers model, stepping-upmodel, and low velocity layer model to get the snapshot result and syntheticseismic data. To address the goal of developing dispersion curveproperties, this research is divided into 3 steps. First, we will obtain theinput parameter such as P-Wave model, S-Wave model, density model, sourceposition, receiver interval, and recording time. Second, we will define sourceparameter.

Ricker wavelet with dominant frequency 25 Hz is used as source inthis program. Third, Boundary condition is represented naturally by changes ofelastic parameter and density as they are in a heterogeneous formulation. Examples –Synthetic Data We Generate three models are used in thissimulation: three layers model, stepping-up model, and low velocity layer model(Figure 1).

Before doing simulation, we verify the numerical of dispersioncurve with the theoretical curve that obtained by calculation of two layermedium using Rix and Lai’s algorithm. This comparison shows the suitabilitybetween fundamental-mode of Rayleigh wave. Physical parameter such as P-Wave velocity hasmaximum value 2941 m/s and minimum value 865 m/s, S-Wave velocity has maximumvalue 1700 m/s and minimum value 500 m/s, and Density has maximum value 2000kg/m3 and minimum value 1200 kg/m3. Meanwhile, 25receiver with interval 2 m and 1000 iteration are used in this simulation. Figure 2 shows snapshot of wave propagation at 0.

09 s and 0. 16 s. In this simulation, each recorded time signal istransformed into frequency domain using FFT algorithm. Considering each pair ofsignals, an estimate of the relationship between wave velocity andfrequency over a certain range of frequency isobtained. For stepping-up model we can analyse fundamental mode at range 10 Hz– 60 Hz (Figure 3) and showsthe suitability with analytic equation of Rix and Lai (Rix and Lai, 2003)   Figure 1 Three different models areused in this simulation (a) Normal model, (b) Stepping-

up model, (c) Lowvelocity layer model. Each model has a configuration with interval geophone 2 m(triangle), near offset 2m. Meanwhile, stepping up model has 3 shots to studyfundamental mode variations with subsurface features.

Figure 2 The snapshot of wavepropagation (a) at 0. 09 s and (b) at 0. 16 s (c) (b) (a) Figure 3 Dispersion curve snapshot (a)at shot 12 m (b) at shot 75 m (c) at shot 150m Dispersion curve which can beobserved has a variation of fundamental mode. This variation is controlled by differenceof shot position to subsurface features. Therefore, subsurface features such aslayer thickness, geological structure beneath the surface, and heterogeneitycontrol the variation of fundamental mode. To study this effect, we mustisolate seismic energy from recorded signal at specified frequency band (Tran, 2008). Conclusions Resulting dispersion curves show match in the highfrequency range for three layers model with the theoretical of dispersioncurves.

The stepping-up model is used to explore the interaction sourceposition with the near surface structure. When elastic waves interact with thenear surface structure, diffraction process occurs at the location of the nearsurface structure. The near surface structure is suspected to be responsiblefor the complexity of the recorded seismogram. Then, dispersion curve image isextracted from the recorded seismogram which can enhance the structure'ssignature. And low velocity layer model illustrates high-low velocityinterface.

The observed of dispersion curves allows the prediction of change inthe dispersion curves shape under the influence of velocity's medium.

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