



## Problem WP1\_HSP1c

### Purpose

Assess the effect of numerical dispersion and local error in different numerical-modeling methods in case of a material with high Poisson ratio. In order to assess convergence of the computational scheme you should perform at least three different computation (e.g., for three different spatial steps).

### Coordinate System

Right-handed Cartesian,  $x$  positive North,  $y$  positive East,  $z$  positive downward, all coordinates in meters.

### Material Properties

Homogeneous space

$v_p$ [m/s]	$v_s$ [m/s]	density [kg/m <sup>3</sup> ]	$Q_p$	$Q_s$
6 000	600	2 700	Inf.	Inf.

Tab. 1 Material parameters.

### Source

Point dislocation.

The only non-zero moment tensor component  $M_{xy}$  ( $\Phi_s = 0^\circ$ ,  $\delta = 90^\circ$ ,  $\lambda = 0^\circ$ ), which has value  $M_0 = 10^{18}$  Nm .

Moment-rate time history is  $M_0 \cdot \frac{t}{T^2} \exp\left(-\frac{t}{T}\right)$ , where  $T = 0.1$ s.

Moment time history is  $M_0 \cdot \left[1 - \left(1 + \frac{t}{T}\right) \exp\left(-\frac{t}{T}\right)\right]$ , where  $T = 0.1$ s.

### Receivers

*Close receivers*, coordinates are in meters from the source. The coordinates of the receivers are in the Tab. 2.

The first one is approximately at a distance of one minimum wavelength  $\lambda_{\min}$  (5 Hz). The third one is at a distance of three reference wavelengths  $\lambda_{\text{ref}}$  (1 Hz). The second receiver is in the middle between the first and third ones.

The receivers are located along the  $y$  axis,  $xy$  plane diagonal, body diagonal, and also along the line in a general direction, see Fig. 1.

	$x$ [m]	$y$ [m]	$z$ [m]		$x$ [m]	$y$ [m]	$z$ [m]
1.	0	120	0	7.	69	69	69
2.	0	960	0	8.	554	554	554
3.	0	1 800	0	9.	1 039	1 039	1 039
4.	85	85	0	10.	96	64	32
5.	679	679	0	11.	771	514	257
6.	1 273	1 273	0	12.	1 443	962	481

Tab. 2 Coordinates of receivers.

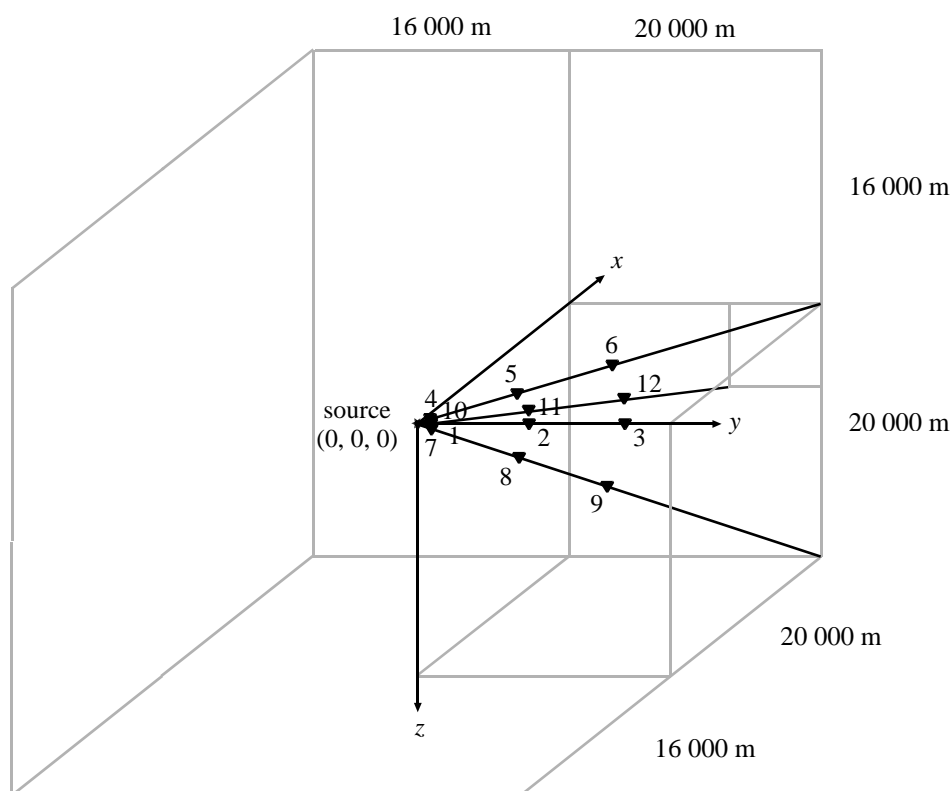


Fig. 1 Geometry for WP1\_HSP1c.

### Time Window

Time window for all receivers is 0 - 5 s.

### Frequency Range

The computation should be accurate enough for the minimal frequency window 0.17 – 5 Hz.

### Other Information

#### Artificial boundary

The computational model must be large enough, so as the seismograms in the receivers do not contain waves, which are due to artificial boundaries of the model.

In the case of a numerical method, in which waves propagating from artificial boundaries of the model can be expected, the following distances should be sufficient: (assuming source at a point (0, 0, 0) ) an orthogonal distance of boundaries from the source – 16 000 m in the negative directions of the  $x$ ,  $y$  and  $z$  axes, and 20 000 m in the positive directions of the  $x$ ,  $y$  and  $z$  axes from the source.

### Output Information

Time histories of particle velocities (in meters/sec.) for all receivers.

Required time step is 0.02 s.

To ensure uniformity in any comparison, do not apply any additional filtering to time series apart from the specified source function.

### Reference Solution

Analytical solution.

### Accuracy Levels

Accuracy Levels evaluated at all defined receivers.

<b>Accuracy Level</b>	<b>EM [%]</b>	<b>PM [%]</b>
Level A	$\leq 5$	$\leq 5$
Level B	$\leq 10$	$\leq 10$
Level C	$\leq 20$	$\leq 20$

EM, PM – Single-valued envelope and phase misfits.

Kristekova et al. (2006)

[http://www.nuquake.eu/Computer\\_Codes/Misfit\\_Criteria\\_KKMD.pdf](http://www.nuquake.eu/Computer_Codes/Misfit_Criteria_KKMD.pdf)