



Strapdown Inertial Navigation System

SINS Nav-5



Purpose of Equipment

SINS Nav-5 is strapdown inertial navigation system designed for railways applications. SINS-Nav5 is based on fiber-optic gyros (FOG) and quartz accelerometers. The system provides continuous determination and output of position coordinates, motion parameters and attitude angles.

SINS Nav-5 incorporates satellite navigation system receiver (GPS or GPS/GLONASS per customer choice). System is compatible with any type of GNSS receiver, capable of NMEA 0183 data output.

To enhance accuracy characteristics in autonomous inertial mode the system can acquire data from external odometer sensor.

System operation

SINS Nav-5 navigation system does not require periodic maintenance or sensor recalibration throughout the life span.

Mounting

The navigation system unit must be installed on horizontal surface within railway vehicle and firmly fixed with screws. Optimal system location is close to the vehicle center of gravity. Tolerance of horizontal and longitudinal positioning of the sensor unit axis is $\pm 5^\circ$.

The GNSS antenna location must provide clear view of the sky.

Operating modes

Alignment

Alignment is activated automatically after system power is on. The alignment lasts 600 seconds. During the alignment the vehicle must be still, the navigation system must not be rotated or lifted!

Alignment stages:

- horizontal alignment (5 min)
- coarse azimuth alignment (3 min)
- fine azimuth alignment (2 min)

Navigation

Navigation mode is activated automatically after alignment is finished. The system can function in autonomous inertial mode or in integrated inertial/GNSS mode (when GNSS data is available). If odometer data is available, autonomous inertial mode with correction from odometer is also possible.

Testing

Fig.1– 4 display the results of the SINS Nav-5 performance test in comparison with reference navigation system data. All data corresponds to autonomous inertial mode of SINS Nav-5 navigation solution calculation.

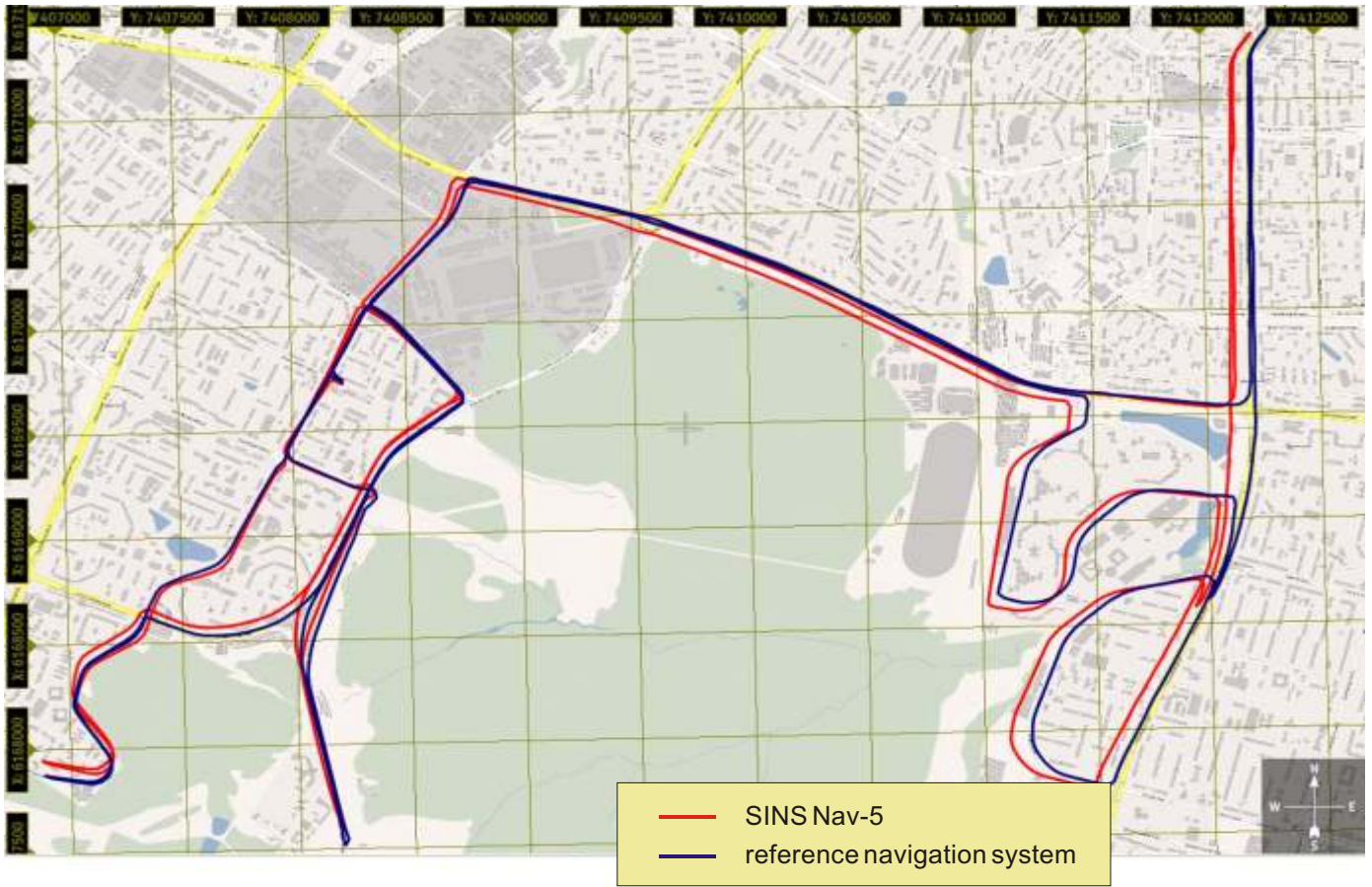


Figure 1. SINS Nav-5 position (inertial mode)

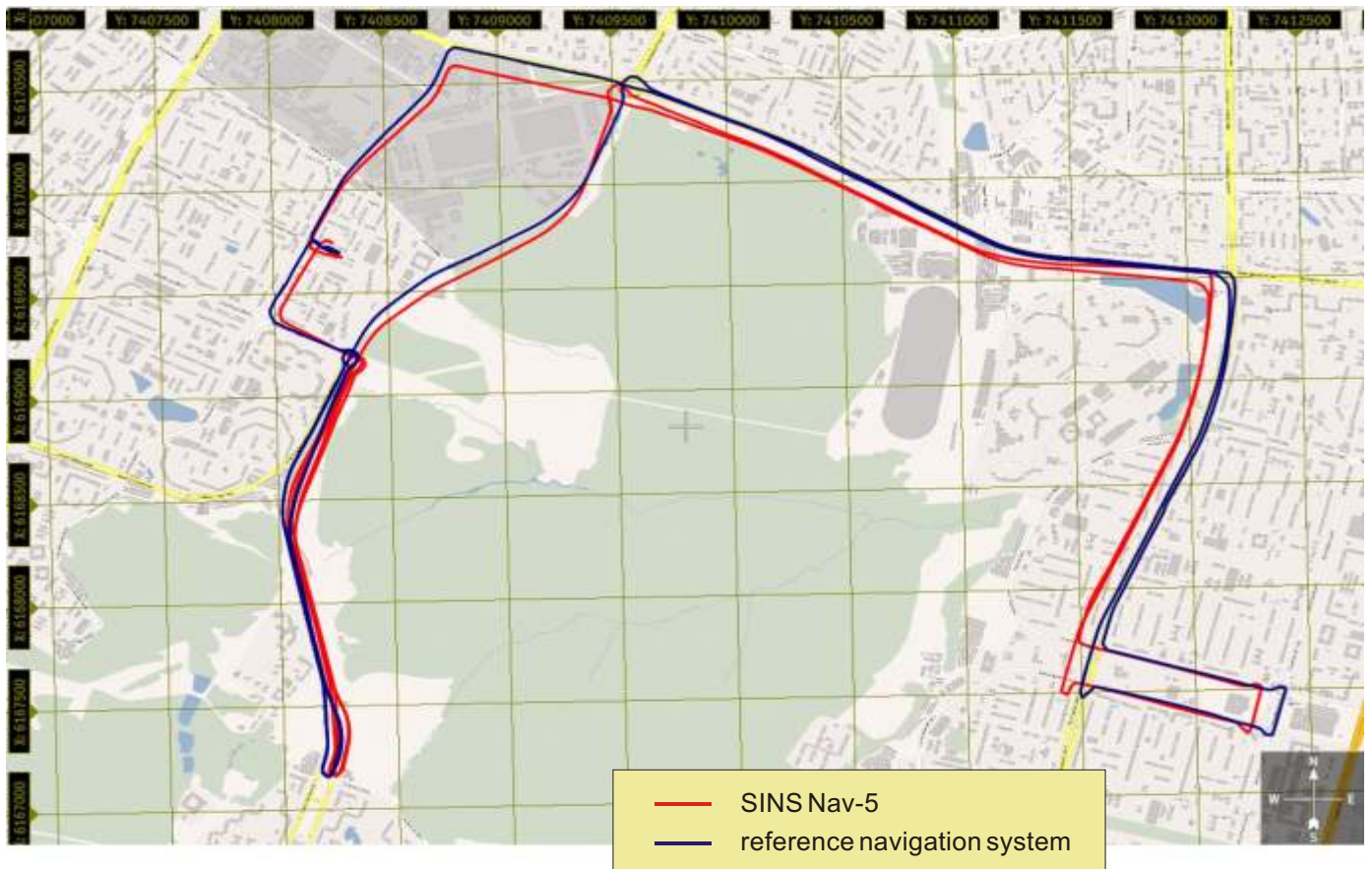


Figure 2. SINS Nav-5 position (inertial mode)

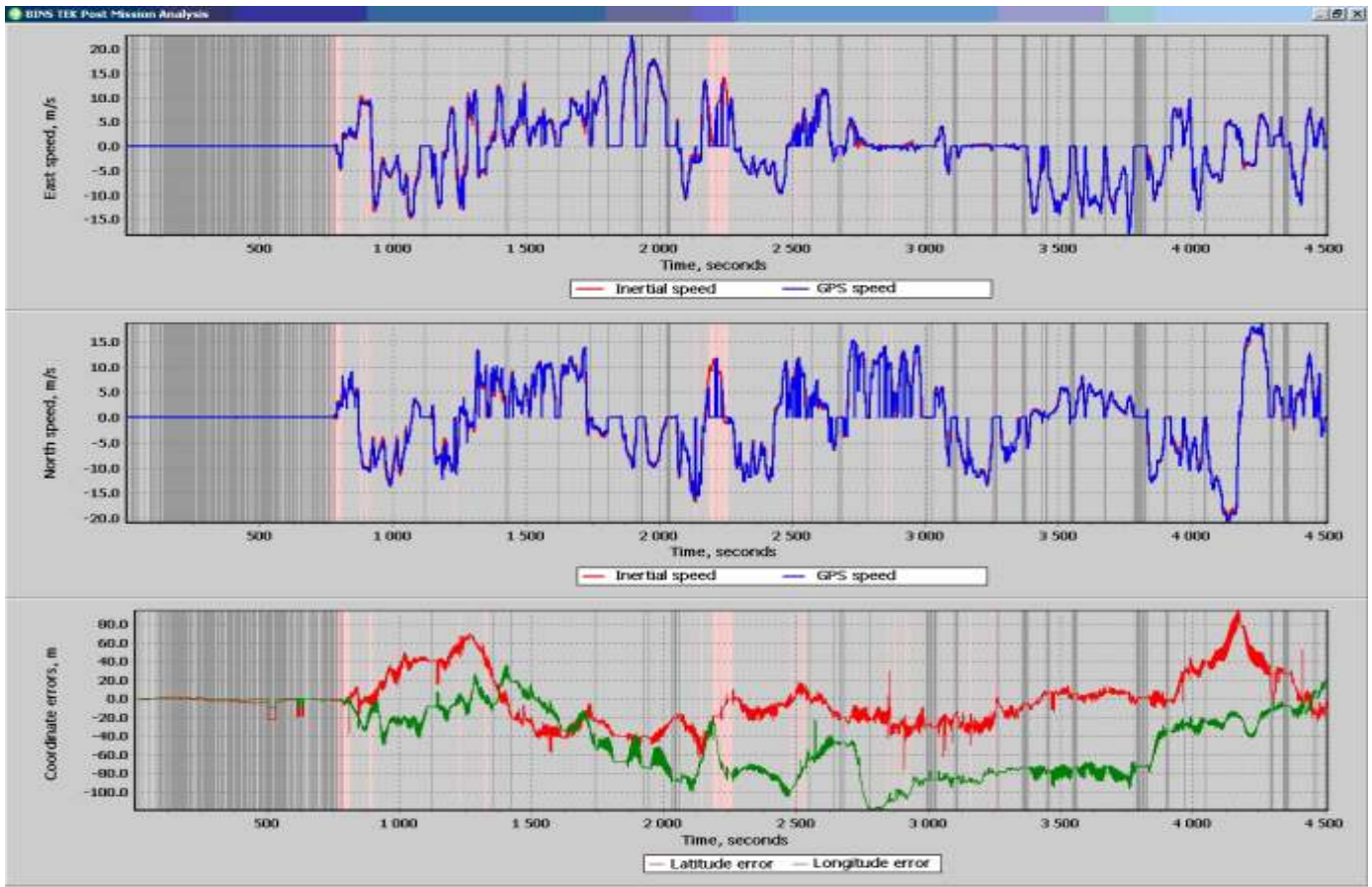


Figure 3 . Speed and position error (inertial mode)

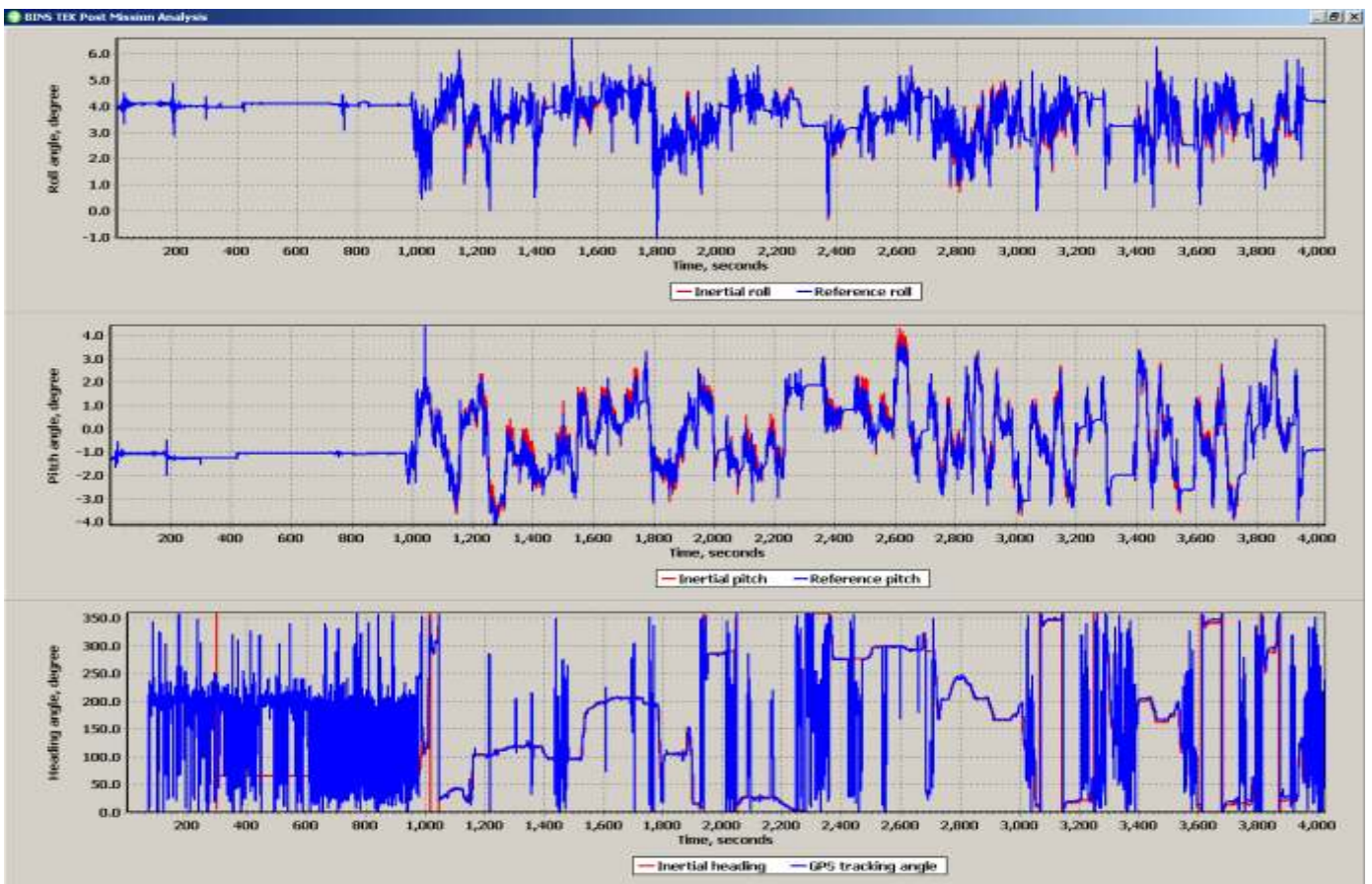


Figure 4. Attitude data

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SINS Nav-5 navigation system consists of:

- Inertial sensors and digital processing unit with built in GNSS receiver
- GNSS receiver antenna
- Commutation cables

Technical characteristics

Operating Ranges

Angular rate	±60 °/s
Acceleration	±6g
Speed	up to 1500 km/h
Pitch	±90°
Roll	±180°
Heading	0..360°
Latitude	±90°
Longitude	±180°

Accuracy¹

Integrated INS/GNSS mode

Inertial mode (with correction from odometer)

Horizontal coordinates	6 m	0.2% of distance travelled 0.15% of distance travelled (ZUPT mode)
Ground speed	0.15 m/s	1 m/s
Vertical speed	0.3 m/s	0.5 m/s
Attitude (roll, pitch) dynamic accuracy	0.05°	0.1°
Heading dynamic accuracy	0.1°	0.2° (per 1 hour)
Altitude	6 m	8 m

Data output

Interface	RS232, RS422(2 ports)
Output data rate	100 Hz
Data format	binary
Cold start	10 min

Environmental

Operating temperature	-20..+75°C
Storage temperature	-50..+80°C
Humidity	5..98%
Pressure	450..850 mmHg

Electrical

Input voltage	20..27 VDC
Power	17 W

Physical

Size	245x180x144 mm
Weight	5.5 kg

* all data is 1σ

¹ Accuracy data subject to change without notice

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Dimensional drawing

