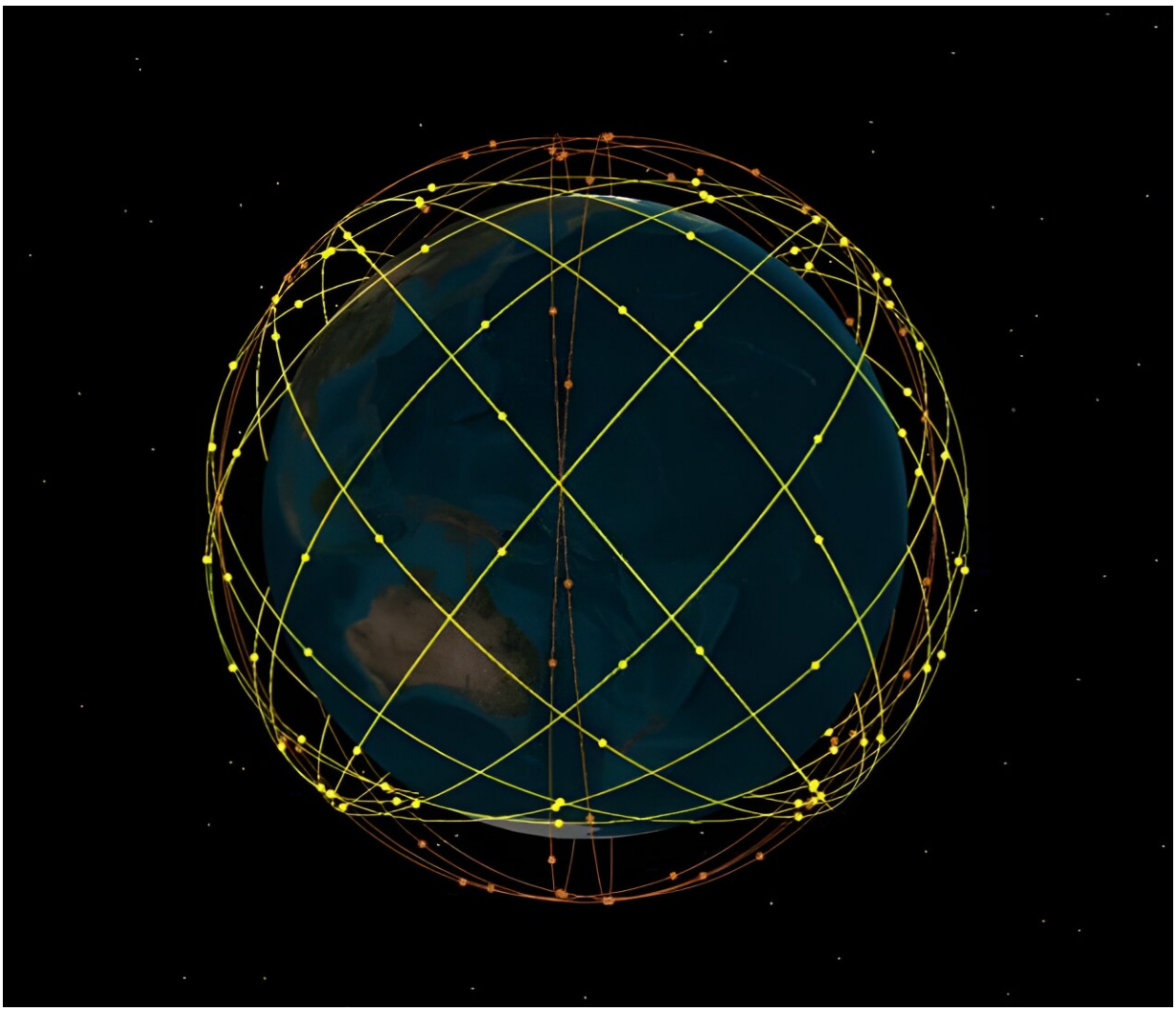
Advancing satellite-based PNT service: Low Earth orbit satellite constellations augment the GNSS

May 7 2024



Demand and key technology for a LEO constellation as augmentation of satellite navigation systems. Credit: *Satellite Navigation* (2024). DOI:

10.1186/s43020-024-00133-w

A study has outlined the critical needs and essential technologies for a low Earth orbit (LEO) constellation to augment satellite navigation systems, significantly improving the Positioning, Navigation and Timing (PNT) services. This research specifically targets the diverse demands of different users for LEO augmented Global Navigation Satellite Systems (GNSS), the possible contribution of LEOs to PNT performances, and the key technologies referring to the LEO-based navigation augmentation system.

The GNSS, including the BeiDou Navigation Satellite System (BDS), are the most widely used in providing PNT services. However, GNSS signals from geostationary orbit (GEO), inclined geosynchronous orbit (IGSO), and medium Earth orbit (MEO) satellites often face interference issues due to their low received signal power.

Additionally, the PNT service performance is relatively poor in polar regions because of the limited inclination angles of all MEO and IGSO satellites. This vulnerability compromises the accuracy and reliability of PNT services provided by the GNSS.

In a study published in *Satellite Navigation* on 29 April 2024, researchers from the Xi'an Research Institute of Surveying and Mapping introduced the augmentation to satellite navigation systems by integrating LEO constellations. This development is set to significantly refine the precision and reliability of global PNT services.

The integration of LEO constellations with the GNSS, can fulfill the requirements of some special PNT users that cannot be fulfilled with existing GNSS. The study's findings indicate that different kinds of PNT

users have different demands for LEO navigation enhancement, and the special demands of particular user groups must be taken into consideration. The research also proposes the key technologies for the construction of LEO navigation augmentation constellation.

Dr. Yuanxi Yang, the lead researcher and correspondent for the article, highlighted the impact of these enhancements, "LEO constellations can significantly enhance not only the accuracy, continuity and availability of PNT service, but also the reliability, integrity and safety for PNT users."

This advance marks a critical progress in satellite navigation technology, promising to improve the quality of existing GNSS. The reasonable design of LEO satellites ensures a more secure satellite-based PNT service system, fulfilling more requirements of special users.

More information: Yuanxi Yang et al, Demand and key technology for a LEO constellation as augmentation of satellite navigation systems, *Satellite Navigation* (2024). DOI: 10.1186/s43020-024-00133-w

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Citation: Advancing satellite-based PNT service: Low Earth orbit satellite constellations augment the GNSS (2024, May 7) retrieved 28 June 2024 from https://techxplore.com/news/2024-05-advancing-satellite-based-pnt-earth.html

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