异常点增强灵敏度——高灵敏度光纤传感器的新范例

DOI: 10.12086/oee.2025.251001.h01

奇异 (EP) 点增强型弯曲传感器优势在于其微小信号的检测能力，例如安全事故初期的微弱信号，有望为保护隧道、桥梁和核电站等重要基础设施提供解决方案。

暨南大学微波光子课题组在全光纤结构中引入了一种特殊点增强型弯曲传感器，利用光纤中 EP 的独特特性，实现了对特定点附近弯曲力的高灵敏度检测。与传统的线性传感器相比，EP 增强型传感器在 EP 工作点附近表现出非线性响应，提高传感灵敏度。此外，为了实现高速、高分辨率的传感器测量，研究还采用了微波光子技术，通过将传感器的光谱响应转换到微波域，使用微波网络分析仪进行频谱测量，其分辨率相对光学方法提高 3 个数量级以上，从而解决了 EP 点附近高精度频谱分析的难题。光纤传感技术的这一新方向提供了一种高效的解调方法，提高了传统光纤传感器的灵敏度。该技术的多功能性使其可以应用于各种现有的 FBG 传感器，从而更容易在需要高灵敏度的场合中得到应用。

EP 灵敏度增强技术作为一种新型解调方案，与目前多种光纤传感技术兼容，有望在未来光纤传感系统中得到广泛应用。

Opto-Electronic Advances, 2023, **6**(12): 230019.
https://www.oejournal.org/article/doi/10.29026/oea.2023.230019.

Exceptional-point-enhanced sensitivity — a new paradigm for high-sensitivity fiber sensors

DOI: 10.12086/oee.2025.251001.h01

The sensitivity of a fiber sensor can be enhanced severalfold using an exceptional point (EP). The technique has the potential to transform fiber sensing technology toward a new era of precision and accuracy. While the researchers demonstrated this remarkable capability using a bending sensor, the true power of EP-enhanced sensitivity extends far beyond, with potential applications across various existing fiber sensors.

The microwave photonics group devised a dual-passband microwave-photonic filter, converting the optical spectral response of the sensor to the microwave domain to realize the full potential of this EP-enhanced sensitivity. This clever integration allows for high-speed and high-resolution measurements, unleashing the full power of EP-enhanced sensing. This research represents a notable contribution to fiber optic sensing. The unique capabilities of the EP-enhanced bending sensor enhance precision and sensitivity in a cost-effective manner, making it a promising advancement in the field. The potential to apply this technology to existing fiber optic sensors and its application in safeguarding critical infrastructures signify the far-reaching impact it can have on safety and innovation in various industries.

This work sets the stage for further advancements in fiber optic sensing, opening new possibilities for high-sensitivity measurements with implications for broader practical applications.

Opto-Electronic Advances, 2023, **6**(12): 230019.
https://www.oejournal.org/article/doi/10.29026/oea.2023.230019.