

# FAN Liangdong

Email: liangdongfanshu@gmail.com | Website: <https://liangdongfan.github.io/>

Interests: Graph Theory, Combinatorics, Extreme Graph Theory

## Education

**Shanghai University** Shanghai, China  
Bachelor of Mathematics and Applied Mathematics Sept 2022 – present

- **GPA:** 3.76/4.0
- **Core Course:** Analysis I (90), Analysis II (99), Advanced Algebra I (94), Advanced Algebra II (100), Advanced Algebra III (98), Probability and Statistics(94), Real Analysis(92), Topology(92), Analytic Geometry(95), Differential Geometry(92)
- **Supplementary Reading:** Bondy, J.A., & Murty, U.S.R. (1976). **Graph Theory with Applications**. Macmillan.

## Publications

[1] **L.D. Fan**, L.Y. Kang, J.D. Wu, Spectral extremal graphs of planar graphs with fixed size, arXiv:2410.00310.  
Under review in *European Journal of Combinatorics*

## Research Experience

**Spectral Extremal Graphs of Planar Graphs with Fixed Size** Jul 2024 - Oct 2024  
**Lead author** | Supervisor: Prof. Liying Kang Shanghai, China

- **Abstract:**
  - Tait and Tobin [J. Combin. Theory Ser. B 126 (2017) 137–161] determined the unique spectral extremal graph over all outerplanar graphs and the unique spectral extremal graph over all planar graphs when the number of vertices is sufficiently large. In this paper we consider the spectral extremal problems of outerplanar graphs and planar graphs with fixed number of edges. We prove that the outerplanar graph on  $m \geq 64$  edges with the maximum spectral radius is  $S_m$ , where  $S_m$  is a star with  $m$  edges. For planar graphs with  $m$  edges, our main result shows that the spectral extremal graph is  $K_2 \vee \frac{m-1}{2} K_1$  when  $m$  is odd and sufficiently large, and  $K_1 \vee (S_{\frac{m-2}{2}} \cup K_1)$  when  $m$  is even and sufficiently large. Additionally, we obtain spectral extremal graphs for path, circle and matching in outerplanar graphs and spectral extremal graphs for path, circle and complete graph on 4 vertices in planar graphs.

**Spectral Extremal Graphs in Planar Graphs** Oct 2024 - present  
**Researcher** | Supervisor: Prof. Liying Kang Shanghai, China

- **Current Progress:**
  - For sufficiently large  $n$ , the maximum spectral radius and the unique extremal graph were determined for all planar graphs on  $n$  vertices that do not contain  $Fan_k$  as a subgraph, where  $Fan_k = K_1 \vee P_{k-1}$ .
  - The conjecture by Boots and Royle, and independently by Cao and Vince, positing that for  $n \geq 9$ , the planar graph with the maximum spectral radius is  $P_2 \vee P_{n-2}$ , held for  $n$  greater than  $10^9$ .

## Honors and Awards

- First Prize in the Shanghai University Qian Weichang College Undergraduate Research and Innovation Forum 2024
- Shanghai University Top Academic Scholarship 2024
- Shanghai University Top Academic Scholarship 2023
- National Encouragement Scholarship 2024

## Skills

**Technologies:** Python, C++, SPSS,  $\text{\LaTeX}$