结构工程研究选题分析报告(参考样本)

注：参考样本是指针对其中的一个研究主题做的分析报告，整个报告包含 41 个研究主题。

吴博士科研团队出品

Papergoing

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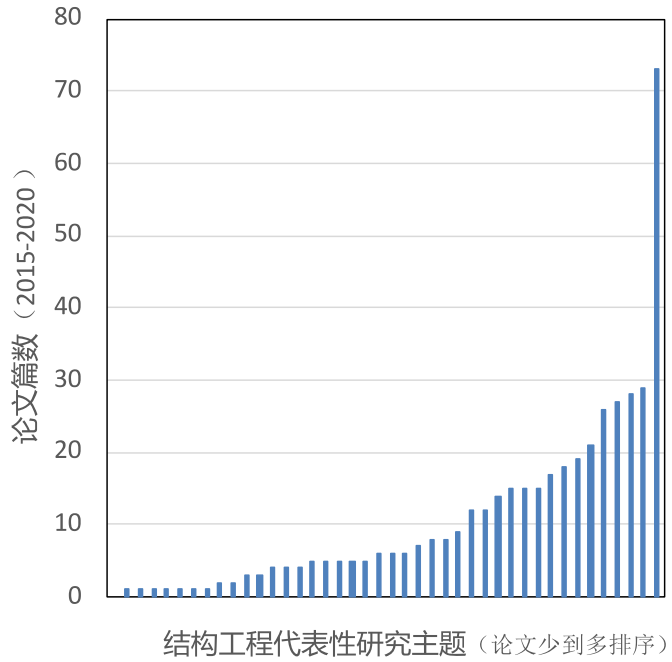
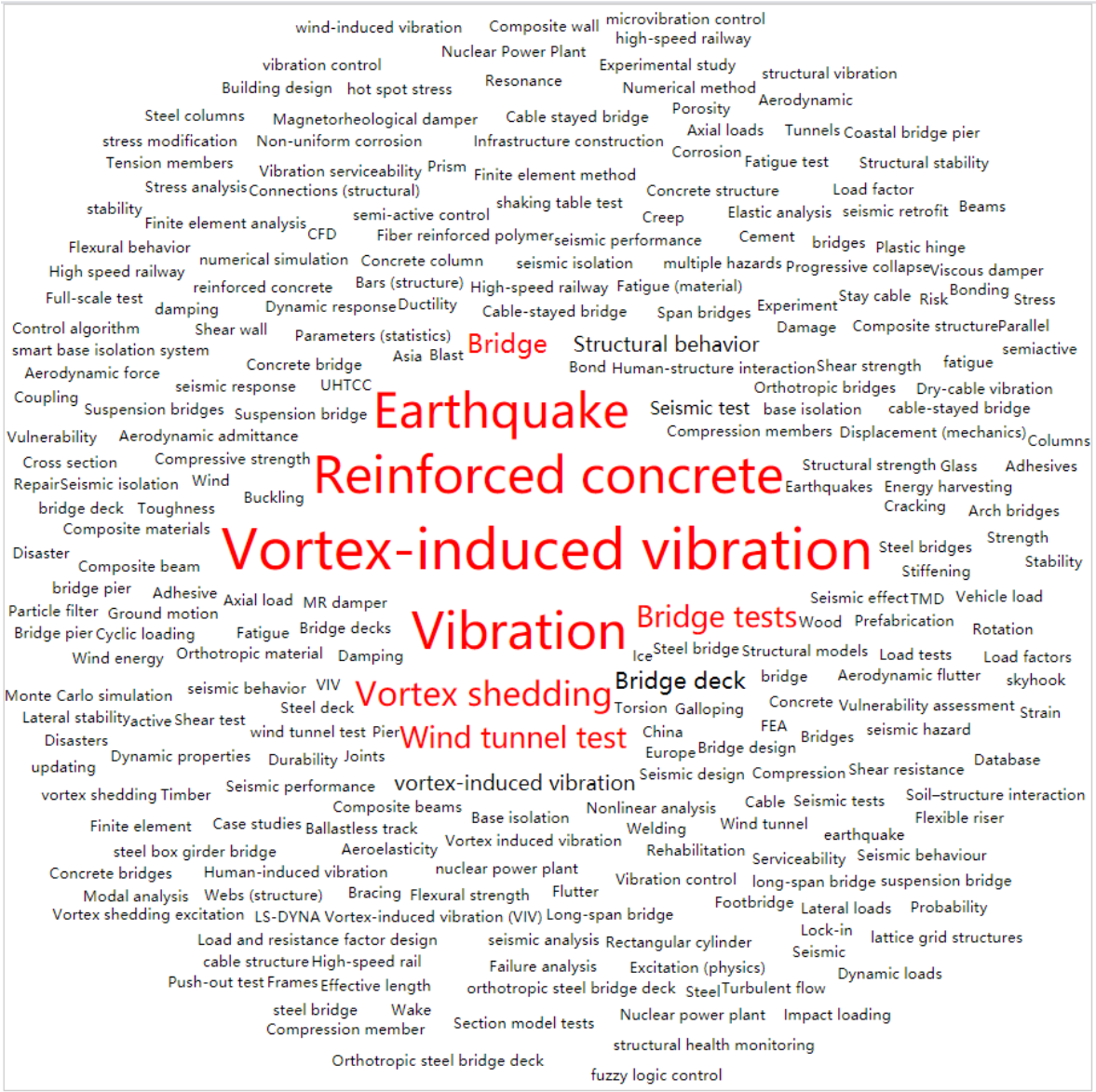
“结构工程”代表性研究主题的热度总体分析

从精选出的 41 个研究主题来看，其 2015-2020 年发表论文篇数分布见图 1。所有主题平均的论文篇数为 6 篇（中位数），最大值为 73 篇（对应的研究主题是“桥梁的涡流振动”），最小值为 0 篇（对应的研究主题是“轴心受压构件的稳定性分析”）。论文篇数的前 25%，50%，75%的四分位值分别为 2.5 篇，6 篇，15 篇。根据该分布，我们定义在“结构工程”领域中，若 2015-2020 年发表的 SCI 论文少于 2.5 篇，则其研究热度低；若 SCI 论文介于 2.5 到 6 篇，则其研究热度一般；若 SCI 论文介于 6 到 15 篇，则其研究热度较高；若 SCI 论文多于 15 篇，则其研究热度很高。图 2 展示出近 6 年来结构工程出现次数前 500 个研究关键词的分布，最热的关键词有 Vortex-induced vibration, Reinforced concrete, Vibration, Earthquake 等，这些关键词作为专业词汇，可作为掌握专业知识的基础素材。



图一 结构工程代表性研究主题的论文篇数（2015-2020）分布



图二 研究关键词分布（云图）

研究方向 1：钝体结构，驰振

解释：钝体是相对于流线体而言的，流线体是前圆后尖、表面光滑、略像水滴的形状。具有这种形状的物体在流体中运动时，流体沿物体的轮廓流动，基本不产生分离和尾流，因而受到的阻力最小。而对于钝体，即非流线体，如圆柱、球、桥墩等等，在其边界上会形成流动分离，后部会产生宽阔的尾流，并伴有旋涡脱落现象。

——武岳，孙瑛，郑朝荣等编著,风工程与结构抗风设计,哈尔滨工程大学出版社,2014.05,第 40 页

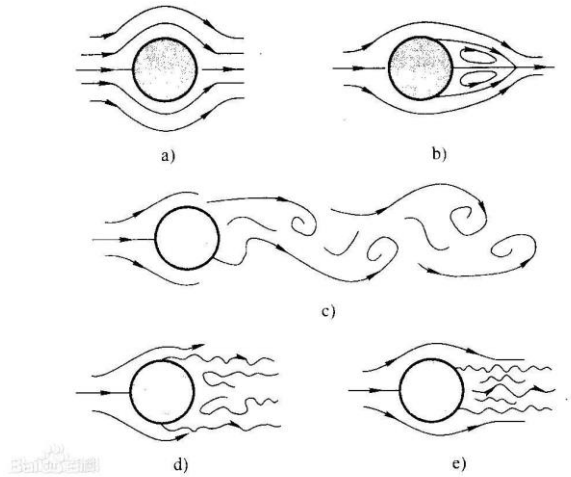


图 1-1 流体通过钝体示意图-来自百度百科

驰振一般发生在复杂不规则的非流线型截面的结构中，如钝体。驰振产生的机理是由于升力曲线具有负斜率，所以说使得空气升力具有负阻尼作用，从而使结构能够源源不断地从外界吸收能量，从而形成类似颤振的发散振动现象。根据产生机理的不同，驰振可以分为尾流驰振和横流驰振两种。尾流驰振是由绕过前方结构的波动性来流激发下游结构物产生的不稳定振动。比如说斜拉桥的拉索、悬索桥吊杆最容易发生尾流驰振。横流驰振是由升力曲线的负斜率所引起的发散性弯曲自激振动。这种负斜率使得振动过程中结构的位移始终与空气力的方向相一致，结构不断从外界吸收

能量，从而形成不稳定振动。横流驰振一般发生在具有棱角的非流线型截面的柔性轻质结构中，悬吊体系桥梁结构中的拉索和吊杆最有可能发生横流驰振。此外，对于宽高比较小的梁式钢桥，高柔的大跨径斜拉桥、悬索桥桥塔以及连续钢构桥在最大悬臂施工阶段的主梁都存在着发生驰振发散的可能性。

——郝浩，桥梁结构的驰振现象及其控制，长安大学，硕士论文，2010.

研究热度：图 1-2 所示，近六年以来，该研究主题相关的 SCI 论文数量先降后升，到了 2019 年达到峰值为 8 篇，五年总的 SCI 论文有 22 篇。总体而言，该研究主题的热度**较高**，且未来的研究热度有增加的趋势。在 SCI 论文中出现最多的关键词是 Galloping, Wind Energy, Energy harvesting 等（见图 1-3）。

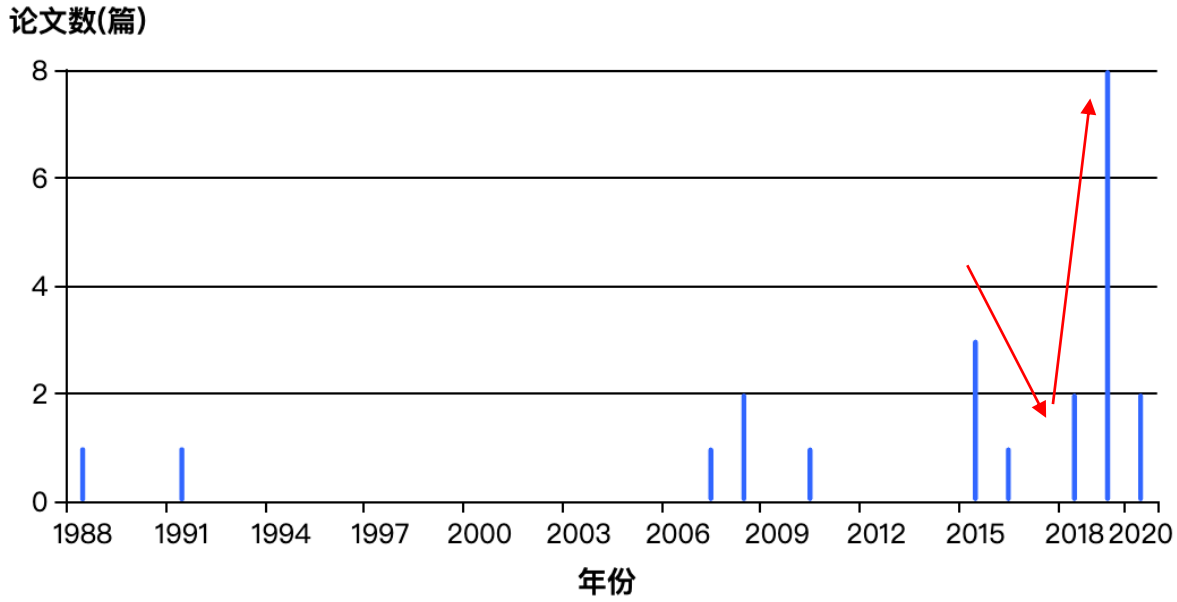


图 1-2 近年研究热度变化图

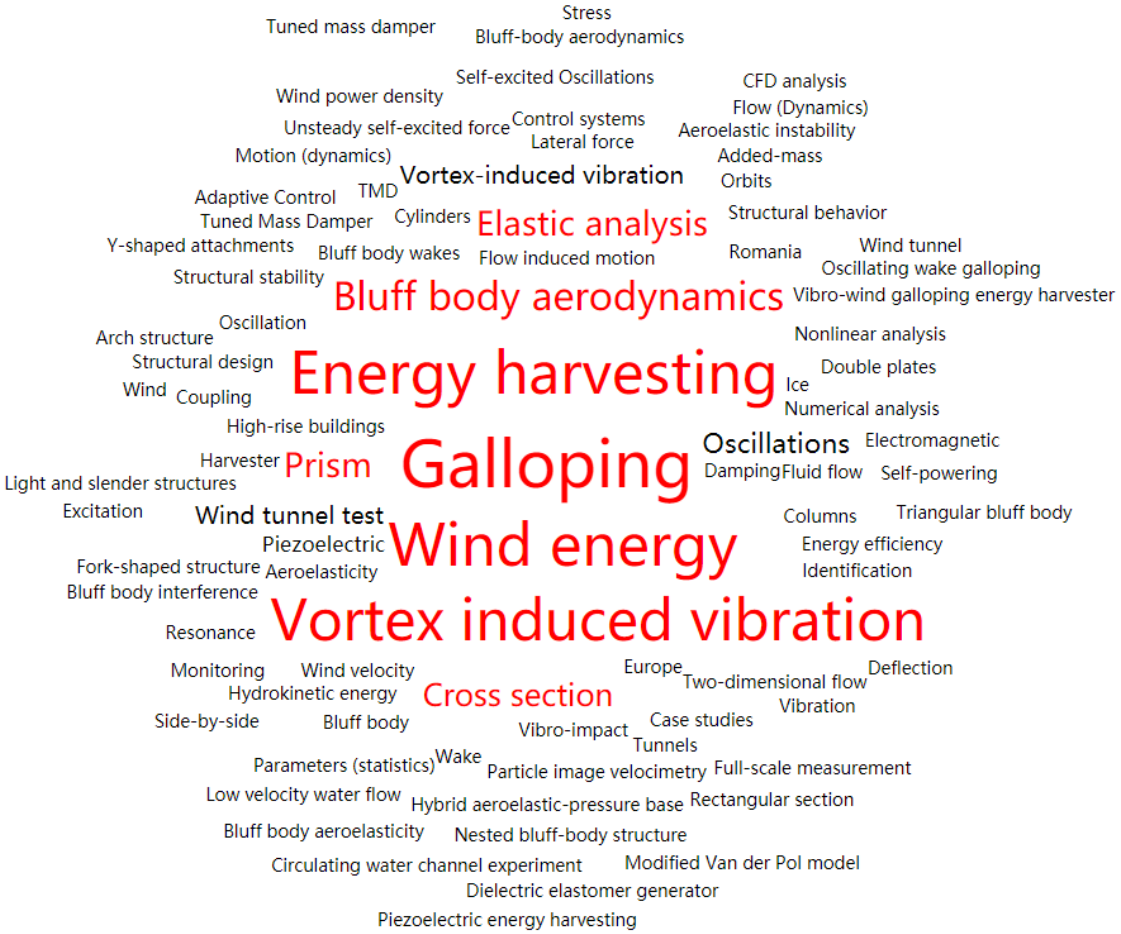


图 1-3 研究关键词分布（云图）

主题相关的高水平学术论文

表 1-1 包含的 SCI 论文（最新论文，共 20 篇）

标题（按发表时间排序，由近到远）	所在期刊	影响因子
1、Modelling unsteady self-excited wind force on slender prisms in a turbulent flow	Engineering Structures	**3.084**
2、Performance enhancement of wind energy harvester utilizing wake flow induced by double upstream flat-plates	Applied Energy	**8.426**
3、Harvest wind energy from a vibro-impact DEG embedded into a bluff body	Energy Conversion and Management	**7.181**
4、Theoretical modeling, wind tunnel measurements, and realistic environment testing of galloping-based electromagnetic energy harvesters	Applied Energy	**8.426**
5、Low velocity water flow energy harvesting using vortex induced vibration and galloping	Applied Energy	**8.426**
6、Development of a novel vibro-wind galloping energy harvester with high power density incorporated with a nested bluff-body structure	Energy Conversion and Management	**7.181**
7、Fork-shaped bluff body for enhancing the performance of galloping-based wind energy harvester	Energy	**5.537**
8、Wind-induced response of light and slender arched structures in twin arrangement: Wind tunnel tests and full-scale monitoring	Engineering Structures	**3.084**
9、Efficiency investigation on energy harvesting from airflows in HVAC system based on galloping of isosceles triangle sectioned bluff bodies	Energy	**5.537**
10、High-performance piezoelectric wind energy harvester with Y-shaped attachments	Energy Conversion and Management	**7.181**
11、Broadening Band of Wind Speed for Aeroelastic Energy Scavenging of a Cylinder through Buffeting in the Wakes of a Squared Prism	Shock and Vibration	**1.628**
12、Aeroelastic stability of two long-span arch structures: A collaborative experience in two wind tunnel facilities	Engineering Structures	**3.084**
13、Modeling and Characterization of a Piezoelectric Energy Harvester Under Combined Aerodynamic and Base Excitations	Journal of Vibration and Acoustics	**1.929**
14、Flow induced motion and energy harvesting of bluff bodies with different cross sections	Energy Conversion and Management	**7.181**
15、Determination of Maximum Mechanical Energy Efficiency in Energy galloping Systems	Journal of Engineering Mechanics	**2.264**

16、Quantitative visualization of the flow around a square-section cylinder at incidence	Journal of Wind Engineering and Industrial Aerodynamics	**3.01**
17、Influence of Structural Design on the Aeroelastic Stability of Brancusi's Endless Column	Journal of Engineering Mechanics	**2.264**
18、An adaptive mass damper for self-excited oscillations	Structural Control & Health Monitoring	**3.74**
19、Chaotic Motions of Self-Excited Forced and Autonomous Square Prisms	Journal of Engineering Mechanics	**2.264**
20、Predicting galloping Amplitudes	Journal of Engineering Mechanics	**2.264**
其中含综述 0 篇：		
其中含实验研究论文 16 篇：		
1、Modelling unsteady self-excited wind force on slender prisms in a turbulent flow	Engineering Structures	**3.084**
2、Harvest wind energy from a vibro-impact DEG embedded into a bluff body	Energy Conversion and Management	**7.181**
3、Theoretical modeling, wind tunnel measurements, and realistic environment testing of galloping-based electromagnetic energy harvesters	Applied Energy	**8.426**
4、Low velocity water flow energy harvesting using vortex induced vibration and galloping	Applied Energy	**8.426**
5、Development of a novel vibro-wind galloping energy harvester with high power density incorporated with a nested bluff-body structure	Energy Conversion and Management	**7.181**
6、Fork-shaped bluff body for enhancing the performance of galloping-based wind energy harvester	Energy	**5.537**
7、Wind-induced response of light and slender arched structures in twin arrangement: Wind tunnel tests and full-scale monitoring	Engineering Structures	**3.084**
8、Efficiency investigation on energy harvesting from airflows in HVAC system based on galloping of isosceles triangle sectioned bluff bodies	Energy	**5.537**
9、High-performance piezoelectric wind energy harvester with Y-shaped attachments	Energy Conversion and Management	**7.181**
10、Broadening Band of Wind Speed for Aeroelastic Energy Scavenging of a Cylinder through Buffeting in the Wakes of a Squared Prism	Shock and Vibration	**1.628**

11、Aeroelastic stability of two long-span arch structures: A collaborative experience in two wind tunnel facilities	Engineering Structures	**3.084**
12、Modeling and Characterization of a Piezoelectric Energy Harvester Under Combined Aerodynamic and Base Excitations	Journal of Vibration and Acoustics	**1.929**
13、Flow induced motion and energy harvesting of bluff bodies with different cross sections	Energy Conversion and Management	**7.181**
14、Determination of Maximum Mechanical Energy Efficiency in Energy galloping Systems	Journal of Engineering Mechanics	**2.264**
15、Quantitative visualization of the flow around a square-section cylinder at incidence	Journal of Wind Engineering and Industrial Aerodynamics	**3.01**
16、Chaotic Motions of Self-Excited Forced and Autonomous Square Prisms	Journal of Engineering Mechanics	**2.264**
其中含数值模拟论文 3 篇：		
1、Low velocity water flow energy harvesting using vortex induced vibration and galloping	Applied Energy	**8.426**
2、Efficiency investigation on energy harvesting from airflows in HVAC system based on galloping of isosceles triangle sectioned bluff bodies	Energy	**5.537**
3、Chaotic Motions of Self-Excited Forced and Autonomous Square Prisms	Journal of Engineering Mechanics	**2.264**
其中含理论分析论文 5 篇：		
1、Modelling unsteady self-excited wind force on slender prisms in a turbulent flow	Engineering Structures	**3.084**
2、Theoretical modeling, wind tunnel measurements, and realistic environment testing of galloping-based electromagnetic energy harvesters	Applied Energy	**8.426**
3、Low velocity water flow energy harvesting using vortex induced vibration and galloping	Applied Energy	**8.426**
4、High-performance piezoelectric wind energy harvester with Y-shaped attachments	Energy Conversion and Management	**7.181**
5、Modeling and Characterization of a Piezoelectric Energy Harvester Under Combined Aerodynamic and Base Excitations	Journal of Vibration and Acoustics	**1.929**

分析 1:论文发表的期刊影响力情况

从表 1-1 来看，该领域发表的 SCI 论文所在的 SCI 期刊影响因子平均为 3.104。在土木工程中，所有 SCI 期刊的平均影响因子为 1.855，因此该领域的研究成果的平均质量较高，且主要发表在了较高影响因子的 SCI 期刊上，在与大同行学术成果的对比中具有较高的竞争力。

同时，在结构工程 SCI 期刊中平均影响因子为 1.947 的情况下，该领域的研究成果所在的期刊水平也远高于平均水平，在小同行中将具有较高声誉。

分析 2:论文研究手段分析

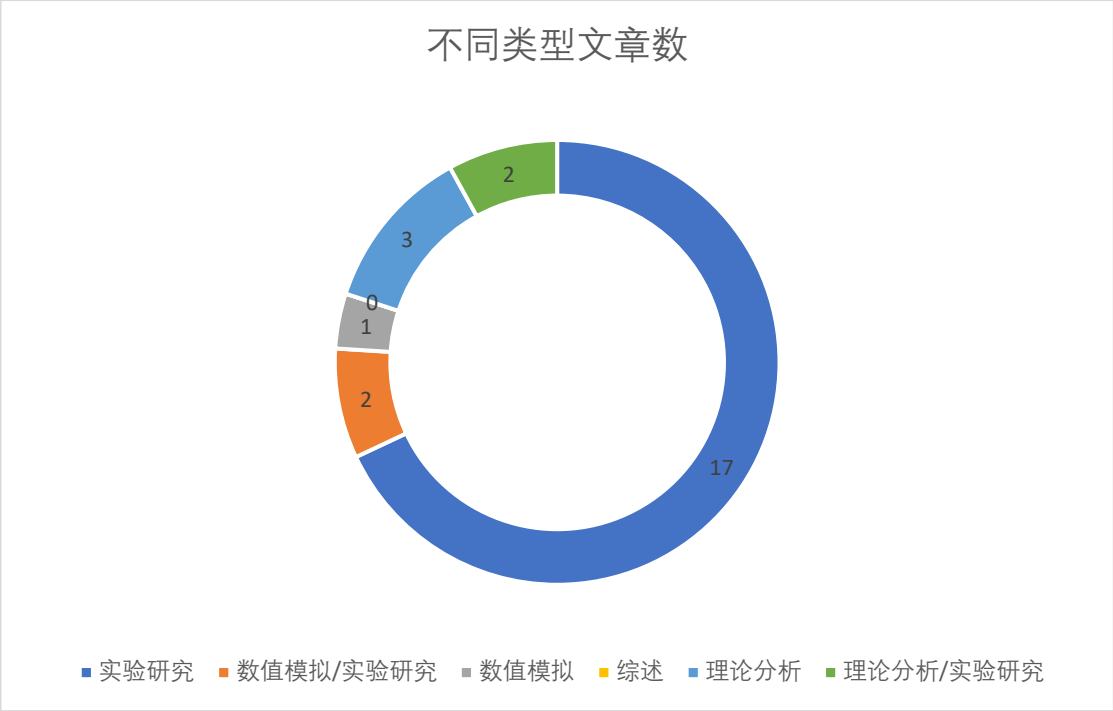


图 1-4 不同类型文章数占比图

该研究目前综述论文为零，考虑该方向研究热度较高，可尝试撰写该方向的 SCI 综述。该研究目前实验分析占比达到 80%，同时，我们可以看到数值模拟可以和试验研究结合，理论分析也可以和实验结合，实验是该领域的主要研究手段，建议在研究方案的制定过程中，多考虑实验手段。该研究数值模拟和理论分析占比类似且均较低，这是本研究主题的潜在研究方向。

表 1-2 推荐发表的 SCI 期刊

期刊	影响因子	和主题相关论文
Applied Energy	**8.426**	1、Performance enhancement of wind energy harvester utilizing wake flow induced by double upstream flat-plates
		2、Theoretical modeling, wind tunnel measurements, and realistic environment testing of galloping-based electromagnetic energy harvesters
		3、Low velocity water flow energy harvesting using vortex induced vibration and galloping
Energy Conversion and Management	**7.181**	1、Harvest wind energy from a vibro-impact DEG embedded into a bluff body
		2、Development of a novel vibro-wind galloping energy harvester with high power density incorporated with a nested bluff-body structure
		3、High-performance piezoelectric wind energy harvester with Y-shaped attachments
		4、Flow induced motion and energy harvesting of bluff bodies with different cross sections
Energy	**5.537**	1、Fork-shaped bluff body for enhancing the performance of galloping-based wind energy harvester
		2、Efficiency investigation on energy harvesting from airflows in HVAC system based on galloping of isosceles triangle sectioned bluff bodies
Structural Control & Health Monitoring	**3.740**	1、An adaptive mass damper for self‐excited oscillations
Engineering Structures	**3.084**	1、Modelling unsteady self-excited wind force on slender prisms in a turbulent flow
		2、Wind-induced response of light and slender arched structures in twin arrangement: Wind tunnel tests and full-scale monitoring
		3、Aeroelastic stability of two long-span arch structures: A collaborative experience in two wind tunnel facilities
Journal of Wind Engineering and Industrial Aerodynamics	**3.010**	1、Quantitative visualization of the flow around a square-section cylinder at incidence
Journal of Engineering Mechanics	**2.264**	1、Determination of Maximum Mechanical Energy Efficiency in Energy galloping Systems
		2、Influence of Structural Design on the Aeroelastic Stability of Brancusi's Endless Column
		3、Chaotic Motions of Self-Excited Forced and Autonomous Square Prisms
		4、Predicting galloping Amplitudes

Journal of Vibration and Acoustics	**1.929**	1、Modeling and Characterization of a Piezoelectric Energy Harvester Under Combined Aerodynamic and Base Excitations
Shock and Vibration	**1.628**	1、Broadening Band of Wind Speed for Aeroelastic Energy Scavenging of a Cylinder through Buffeting in the Wakes of a Squared Prism

表 1-2 展示的是该研究方向上推荐发表的所有 9 本专业 SCI 期刊（影响因子从高到低），它们均可作为未来投稿时备选的目标期刊。若推荐发表的期刊数量较多（超过 10 本），我们会展示影响因子最高的前 10 本 SCI 期刊，也会展示影响因子较低的后 10 本 SCI 期刊（倒序排列），本主题无。

为了启发读者开展交叉研究，表 1-4 统计了以上 SCI 期刊的发表研究范围。

表 1-4 SCI 期刊的发表范围

期刊	发表研究范围
Applied Energy	Energy conversion and conservation
	The optimal use of energy resources
	Analysis and optimization of energy processes
	Mitigation of environmental pollutants
	Sustainable energy systems
Energy Conversion and Management	Energy generation, utilization, conversion, storage, transmission, conservation, management and sustainability
	Involve various types of energy such as mechanical, thermal, nuclear, chemical, electromagnetic, magnetic and electric
Energy	Energy engineering and research
	Analyses, reviews, and evaluations related to energy
Structural Control & Health Monitoring	Structural control
	Structural Health Monitoring Theory
	Smart materials and structures
Engineering Structures	Structural engineering
	Structural mechanics
	Technology
	Dynamic loadings
	Structural response
Journal of Wind Engineering and Industrial Aerodynamics	Wind engineering
	Social and economic impact of wind effects

Journal of Engineering Mechanics	Bioengineering
	Computational mechanics
	Computer-aided engineering
	Dynamics of structures
	Elasticity
	Experimental analysis and instrumentation
	Fluid mechanics
	Flow of granular media
	Inelastic behavior of solids and structures
	Probabilistic methods
	Properties of materials
	Fracture mechanics
	Stability of structural elements and systems, and turbulence
Journal of Vibration and Acoustics	Vibration
	Acoustics
Shock and Vibration	Shock and vibration measurement, testing, and control
	Impact, earthquake, detonation, and explosion measurement
	Data acquisition and processing
	Theory and modelling of shock and vibration
	Vibration condition monitoring
	Modal testing technology
	Structural health monitoring

	Shock hardening
	Fluid-structure interaction
	Noise generation, control, damping and isolation

表 1-5 国际同行（**TOP 10**）

相关作者	所在单位	主题相关的论文	影响因子总和
Ting Tan	Shanghai Jiao Tong University	1、Performance enhancement of wind energy harvester utilizing wake flow induced by double upstream flat-plates	**16.852**
		2、Low velocity water flow energy harvesting using vortex induced vibration and galloping	
J.L. Wang	Engineering Research Center of Energy Saving Technology and Equipment of Thermal Energy System	1、Harvest wind energy from a vibro-impact DEG embedded into a bluff body	**15.607**
		2、Theoretical modeling, wind tunnel measurements, and realistic environment testing of galloping-based electromagnetic energy harvesters	
Zhien Zhang	The Ohio State University	1、Efficiency investigation on energy harvesting from airflows in HVAC system based on galloping of isosceles triangle sectioned bluff bodies	**14.346**
		2、High-performance piezoelectric wind energy harvester with Y-shaped attachments	
		3、Broadening Band of Wind Speed for Aeroelastic Energy Scavenging of a Cylinder through Buffeting in the Wakes of a Squared Prism	
Guang Meng	Shanghai Jiao Tong University	1、Performance enhancement of wind energy harvester utilizing wake flow induced by double upstream flat-plates	**13.963**
		2、Fork-shaped bluff body for enhancing the performance of galloping-based wind energy harvester	
Wen-Ming Zhang	Shanghai Jiao Tong University	1、Performance enhancement of wind energy harvester utilizing wake flow induced by double upstream flat-plates	**13.963**
		2、Fork-shaped bluff body for enhancing the performance of galloping-based wind energy harvester	
A. Abdelkefi	New Mexico State University	1、Theoretical modeling, wind tunnel measurements, and realistic environment testing of galloping-based electromagnetic energy harvesters	**8.426**
Feng Guo	Chung-Ang University	1、Development of a novel vibro-wind galloping energy harvester with high power density incorporated with a nested bluff-body structure	**7.181**

Claudio Mannini	University of Florence	1、Aeroelastic stability of two long-span arch structures: A collaborative experience in two wind tunnel facilities	**3.084**
Hai Sun	University of Michigan，Harbin Engineering University	1、Modelling of a hydrokinetic energy converter for flow-induced vibration based on experimental data	**2.73**
Michael M. Bernitsas	University of Michigan，Vortex Hydro Energy, Ann Arbor, MI, USA	1、Modelling of a hydrokinetic energy converter for flow-induced vibration based on experimental data	**2.73**

以上这些作者所在单位分布于世界各地，如图 1-5 所示，其中最多的是中国、美国和意大利。图 1-6 展示了该领域所有国际同行作者的合作关系，也给出了排名前三位的作者的发文量和合作者数量。

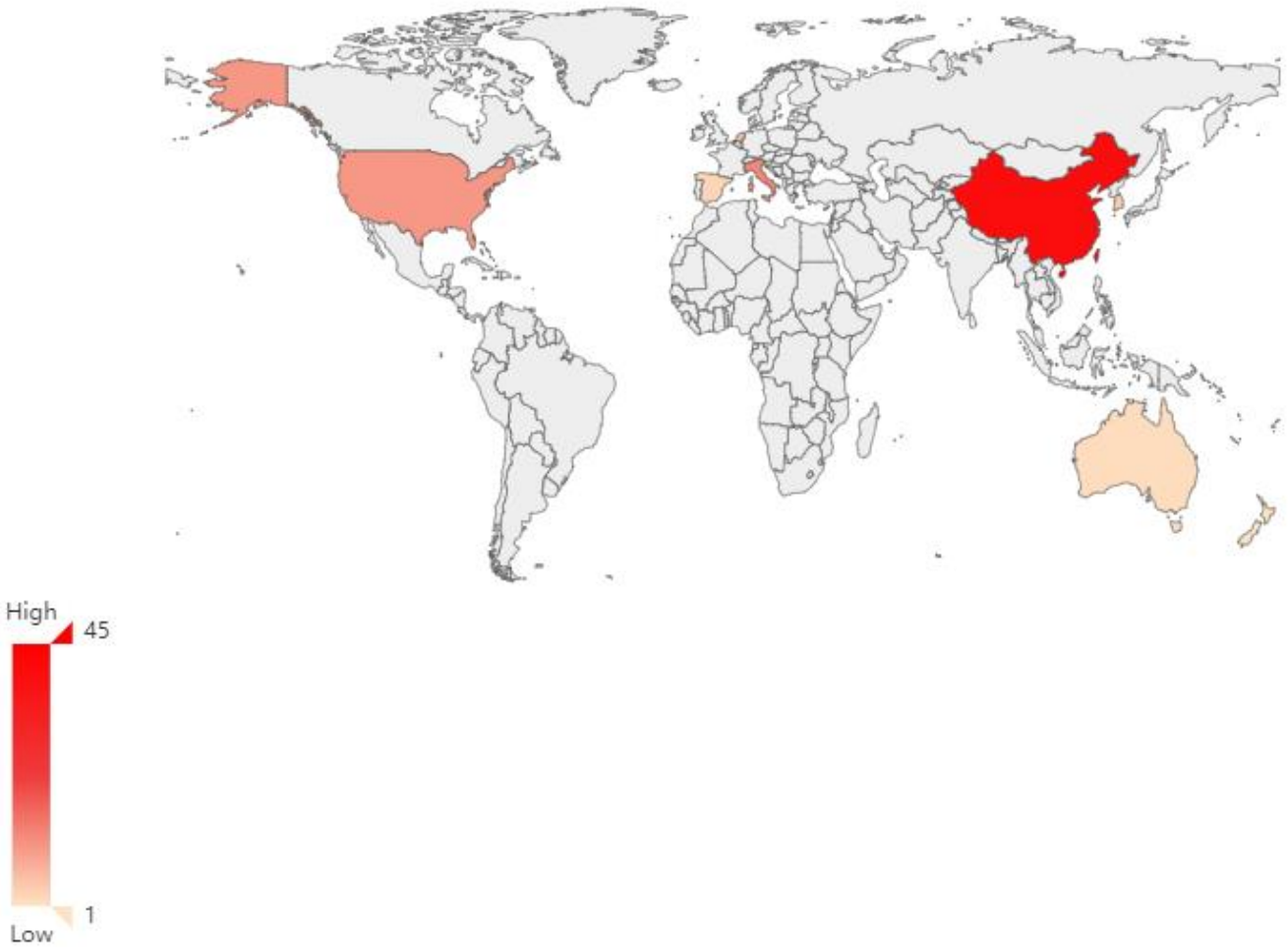


图 1-5 TOP10 研究人员所在地区的分布图

*灰色代表本方向此地区没有相关 SCI 论文的发表

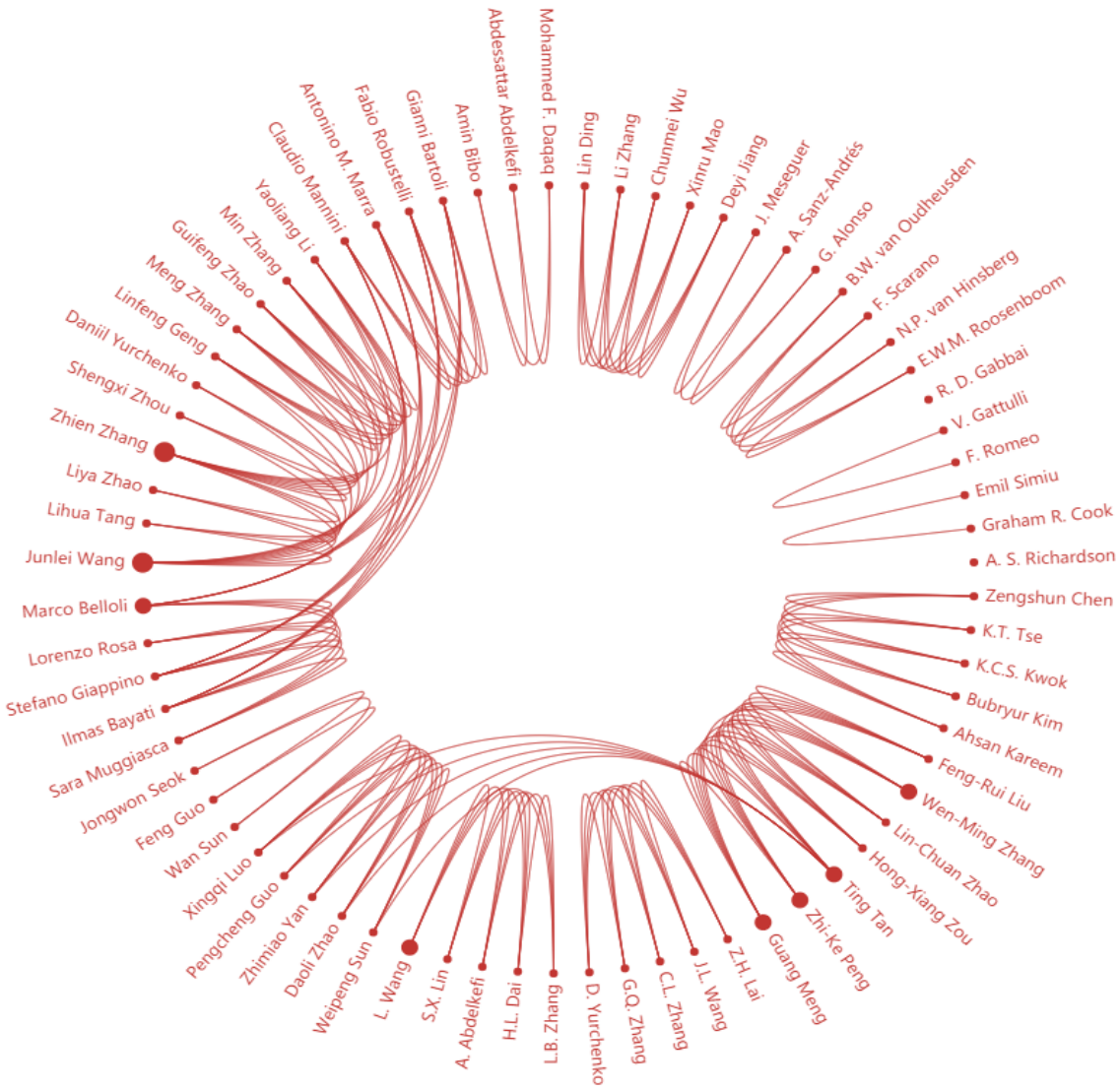


图 1-6 国际同行作者合作关系图

*连线代表有合作关系，作者边上的圆圈越大代表发表论文越多

发文量最高的前三位作者分别是

Zhien Zhang (3 篇)

Guang Meng (2 篇)

L. Wang (2 篇)

合作者最多的前三位作者分别是

Zhien Zhang (10 位)

Junlei Wang (8 位)

Marco Belloli (6 位)