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# Pierre Rouchon, expert in systems control and quantum engineering, joins the Académie des Sciences

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*Pierre Rouchon, professor at the [Centre Automatique et Systèmes \(CAS\)](#) at Mines Paris – PSL and member of the [ENS-INRIA-Mines Quantic](#) team, has been elected a member of the French [Academy of Sciences](#), which recognizes researchers who have made a profound impact on their discipline. This title, awarded after a rigorous selection process by peers, recognizes an exceptional scientific career. A specialist in automatic control and quantum technologies, Pierre Rouchon has contributed to major advances, notably in the real-time control of quantum systems, paving the way for innovative applications in this cutting-edge field.*

An engineer and researcher, Pierre Rouchon combines applied mathematics, engineering and physics to solve complex scientific problems. After graduating from the [École polytechnique](#) (X80), he joined the [Corps des mines](#) before specializing in process engineering, a field that applies physical

chemistry to large-scale industrial installations. His [thesis](#) focused on the study and management of systems for separating different elements in industrial processes. In 2000, he was awarded a Habilitation à Dire des Recherches (HDR) in mathematics.

His academic career led him to teach applied mathematics at the École Polytechnique from 1993 to 2005. At Mines Paris – PSL, he headed the Centre Automatique et Systèmes (CAS) between 1997 and 2002, then the [Mathematics and Systems department](#) until 2018. He contributed to the development of the real-time algorithm used by the team of Serge Haroche, winner of the 2012 Nobel Prize in Physics, during the first experimental realization in 2011 of a quantum feedback loop controlling photons. Since 2015, he has been a member of the Quantic team, made up of researchers from the [Laboratoire de Physique de l'École Normale Supérieure \(LPENS\)](#), Mines Paris – PSL and [the Institut national de recherche en sciences et technologies du numérique \(INRIA\)](#). The main objective of this interdisciplinary team, made up of physicists and applied mathematicians, is to develop both methods and experimental devices, ensuring robust processing of quantum information.

Pierre Rouchon's work earned him the [IMT-Académie des sciences Grand Prix](#) in 2017 and the title of Commander of the [Palmes académiques](#) in 2023.

## Major contributions to control theory and quantum technologies

Pierre Rouchon's work is distinguished by its influence in both fundamental research and industrial applications. He is recognized for several major advances:

- **The theory of differentially flat systems:** these systems, frequently encountered in industry, make it possible to simplify trajectory management and increase the efficiency of complex processes. Thanks to this approach, planning and control problems that were previously difficult to solve can now be dealt with more simply and quickly.
- **Asymptotically invariant observers:** this concept has changed the way we analyze and control real-time systems. It led to the development of the invariant Kalman filter, a tool used in navigation and robotics to improve the accuracy of positioning systems.
- **Quantum control:** in 2011, Pierre Rouchon helped set up the first quantum feedback loop, a device for controlling photons, a milestone in the advancement of quantum technologies.

For several years now, as part of the Quantic team, he has been working on the modeling and control of quantum systems. By exploring the complex phenomena associated with decoherence, his research aims to improve our ability to control quantum systems, a field essential to the future of information and communication technologies.

## Recognition for research at CAS de Mines Paris – PSL

Pierre Rouchon's election to the Académie des Sciences also recognizes the excellence of the Centre Automatique et Systèmes (CAS) at Mines Paris – PSL. This laboratory specializes in the theory and control of dynamic systems. Thanks to his work, Pierre Rouchon is helping to highlight the research carried out at CAS, which is positioned among the major players in the development of advanced control technologies, particularly quantum technologies.

### To find out more

Pierre Rouchon, *Simulation dynamique et commande non linéaire des colonnes à distiller*, PhD thesis, Applied Sciences, Paris ENMP, 1990.

Read →

Article *Prolonged control of cat qubits: a breakthrough in quantum computing published in "Nature"*.

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Pierre Rouchon's CV on the CAS website :

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