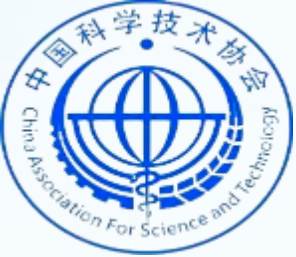


# Brazil's Engineering Capacity





# Brazil's Engineering Capacity

## **Brazil**

Population, GDP Gross Domestic Product, Distribution by region

## **Education in Brazil**

### **The Teaching of Engineering in Brazil**

Courses, Enrollment, Course Completion

Challenges – Drop outs, Quality of teaching and Teacher Education

### **The professionals in the technical areas**

Quantity, Distribution by specialization and by region

### **Highlights of Brazilian Engineering**

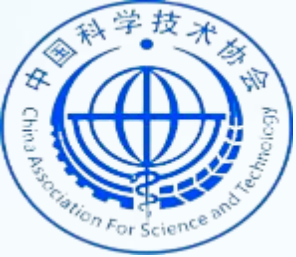
Agricultural Engineering

Civil Engineering

Petroleum Engineering

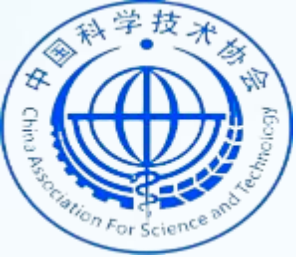
Aeronautical Engineering





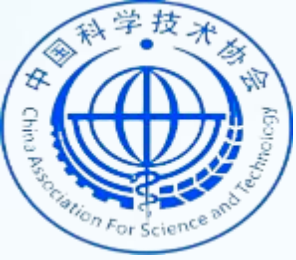
# The Americas





# South America

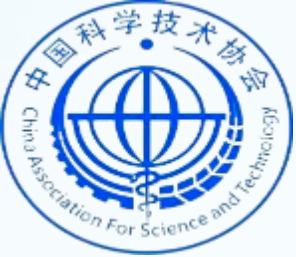




# Brazil

- Brazil is located in South America, where it occupies 47.7% of the total area of the continent.
- It borders seven countries of Spanish origin: Venezuela, Colombia, Peru, Bolivia, Paraguay, Argentina and Uruguay. There are also two countries of Spanish origin, which do not have borders with Brazil, Chile and Ecuador. To the north, Brazil has as its neighbors the three Guianas, former colonies of the United Kingdom, the Netherlands and France.
- Brazil is a new country, with only 518 years old. Its political independence was established in 1822, 196 years ago. It was a colony of Portugal, the very reason for Portuguese being the language spoken in the country.



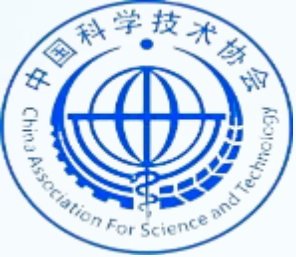


# Brazil

- Its area is of 8,514,876 square kilometers, being bathed along its eastern and part of its northern frontiers by the Atlantic Ocean; 7,367km of coastline.
- It is a country characterized by great contrasts, racial miscegenation, as it was formed by Portuguese people who mixed with the indigenous natives of the country, in addition to Africans and tremendous number of immigrants from all continents.



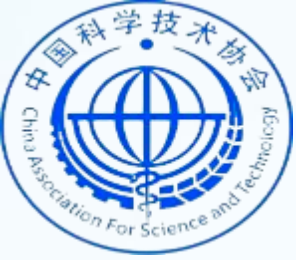




# Brazil

- Spanish America, comprised of Mexico, Central America, and all South America except Brazil and Guyana, was divided into 16 countries despite having the same leaders in their independence processes.
- On the other hand, Brazil remained united thanks to the Portuguese colonization which, in 1808, actually transferred the royal family to the colony, where it stayed a few years, thus fortifying the unit.



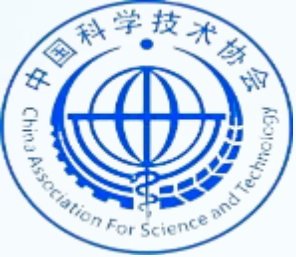


# Brazil

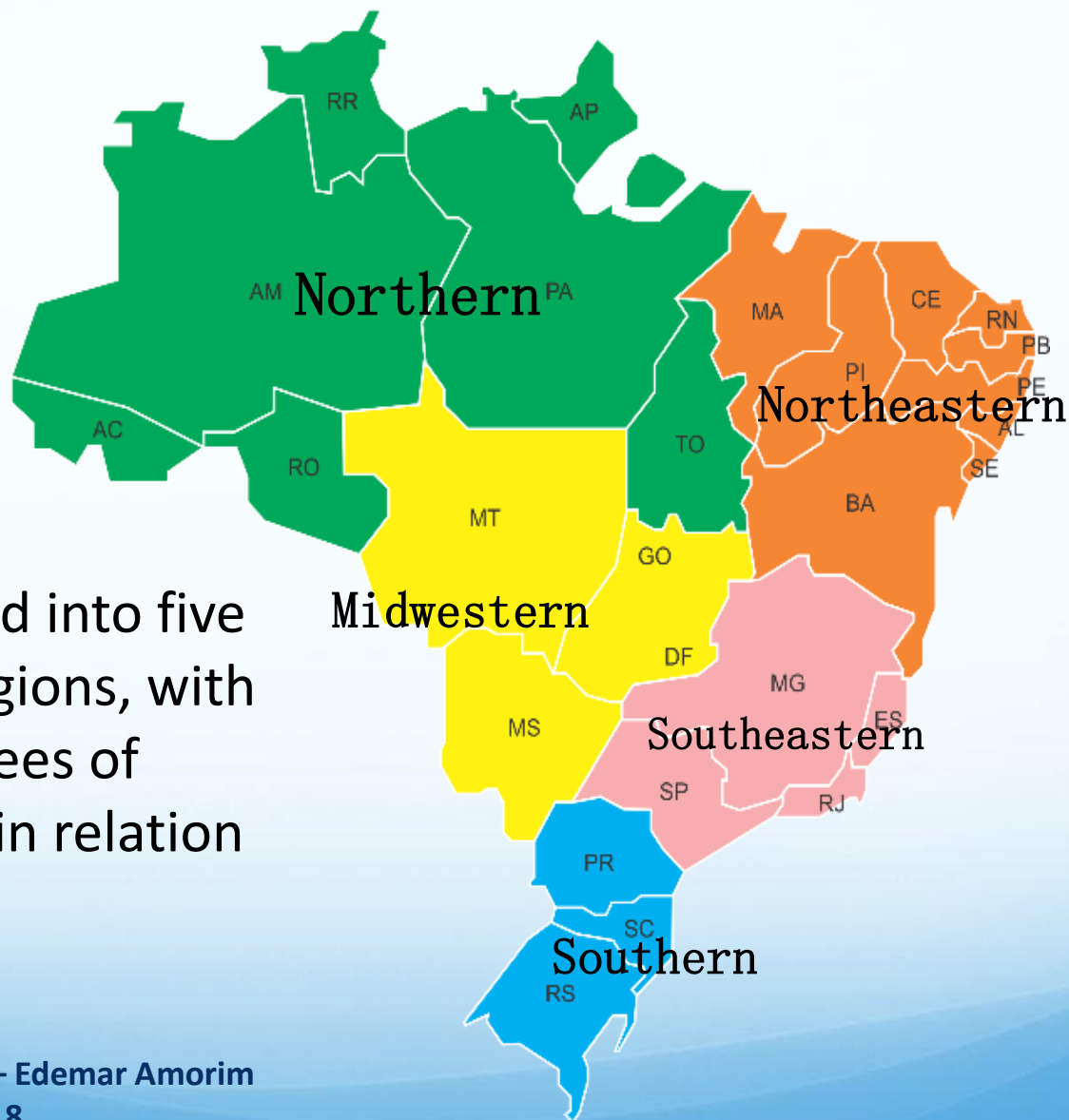
- Population
- GDP Gross Domestic Product
- Distribution by regions





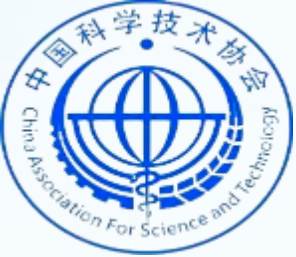


# Brazil Regions



- Brazil is divided into five geographic regions, with different degrees of development in relation to each other.





# Brazil Regions

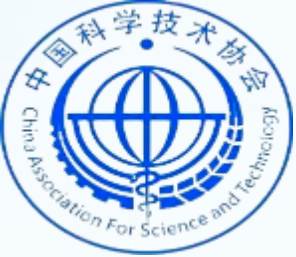
| Region       | Population (MM) | Area (km <sup>2</sup> M) | Inhabitant per km <sup>2</sup> | GDP (US\$B)    | GDP per Capita (US\$M) |
|--------------|-----------------|--------------------------|--------------------------------|----------------|------------------------|
| Northern     | 17.9            | 3,853.4                  | 4.7                            | 167.1          | 9.3                    |
| Northeastern | 57.3            | 1,554.3                  | 36.8                           | 451.2          | 7.9                    |
| Midwestern   | 15.9            | 1,604.9                  | 9.9                            | 320.8          | 20.2                   |
| Southeastern | 86.9            | 924.5                    | 94.1                           | 1,848.1        | 21.3                   |
| Southern     | 29.6            | 576.4                    | 51.4                           | 551.4          | 18.6                   |
| <b>TOTAL</b> | <b>207.7</b>    | <b>8,514.9</b>           | <b>24.4</b>                    | <b>3,341.9</b> | <b>16.1</b>            |





# Northern





# Northern Region

- The northern region, despite being the largest of all, is the one with the smallest population.
- The Amazon Rainforest is located within it, and its population index is 4.65 inhabitants per square kilometer.
- In this region we have important industrial park and large mining projects.
- Its per capita GDP is in the order of US\$ 9,300 per year.

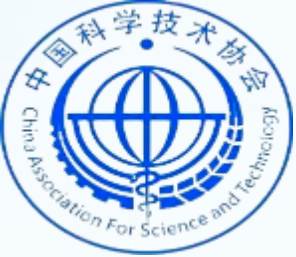






# Northeastern





# Northeastern Region

- The northeastern region is the poorest in the country, with more than 57 million inhabitants. It has a population density of 36.84 inhabitants per square kilometer, and the lowest GDP per capita: US\$ 7,880 per year.
- It is a region with great tourist potential, due to the climate and the beauty of its coast.
- This region is currently in the process of development.



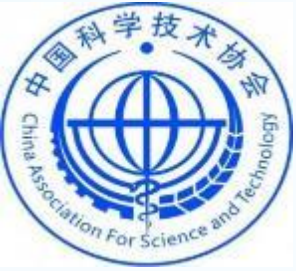




# Midwestern







# Midwestern Region

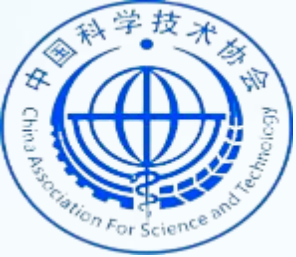
- The midwestern region, which also boast a large territorial extension and low occupancy, has a population coefficient of 9.89 inhabitants per square kilometer, though with a per capita GDP of US\$ 20,208 per year.
- This is due to the great concentration of agricultural production and the development of industries.





# Southeastern





# Southeastern Region

- The southeast region, the most developed, with more than 86 million inhabitants, with a coefficient of 94.05 inhabitants per square kilometer, is the country's Economic and Financial Center.
- With the most industrialized areas and sizable agricultural production, its GDP per capita is US\$21,254 per year.
- In this region, the largest urban concentrations are located: Rio de Janeiro with 12.5 million inhabitants and São Paulo with 22 million inhabitants.

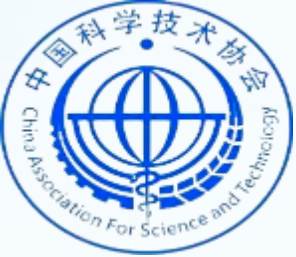






# Southern

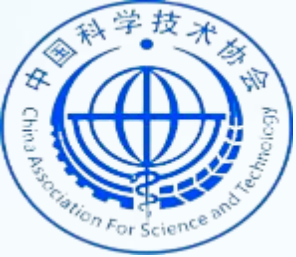




# Southern Region

- The southern region, with the country's second largest population coefficient of 51.43 inhabitants per square kilometer and a total population of 29.6 million is characterized by large industrial and agricultural production and has a GDP per capita of US \$ 18,600 per year.

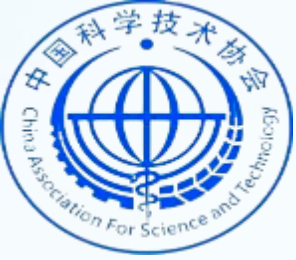




# Education in Brazil

- Kindergarten from 3 to 5 years old
- Primary school from 6 to 14 years old
- High school from 15 to 17 years old
- Technical Education from 18 years of age
- Higher education from 18 years of age (4 to 5 years duration depending on the course chosen)
- Post-Graduate Degree



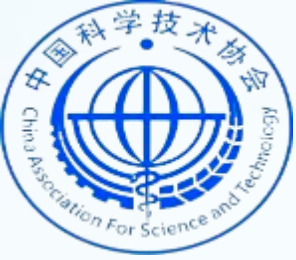


# Engineering Teaching in Brazil

- Courses
- Enrollment
- Course Completion
- Challenges
  - Drop outs
  - Quality of teaching
  - Teacher Education



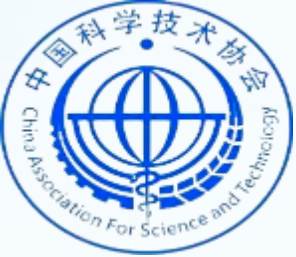




# Engineering Teaching in Brazil

- In order to obtain a degree in engineering, more than 3,000 hours of classes are required in a 5-year course.



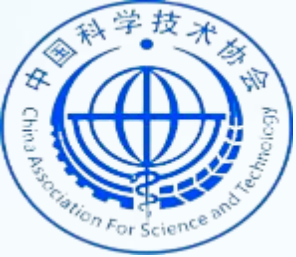


# Engineering Teaching in Brazil

| Class        | Enrolment (M)  |              |              | Graduates (M) |             |             |
|--------------|----------------|--------------|--------------|---------------|-------------|-------------|
|              | Total          | Public       | Private      | Total         | Public      | Private     |
| Architecture | 167,3          | 22,3         | 145,0        | 15,5          | 2,7         | 12,8        |
| Agronomy     | 102,6          | 62,8         | 39,8         | 11,7          | 7,4         | 4,3         |
| Engineering  | 921,4          | 228,2        | 693,2        | 88,5          | 21,1        | 67,4        |
| <b>TOTAL</b> | <b>1.191,4</b> | <b>313,3</b> | <b>878,1</b> | <b>115,7</b>  | <b>31,2</b> | <b>84,5</b> |
|              | 100%           | 26%          | 74%          | 100%          | 27%         | 73%         |

Source: Ministry of Education – 2017

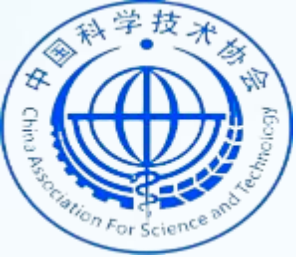




# Engineering Teaching in Brazil

- We see that of 921,412 students enrolled in engineering of all modalities. We have managed to graduate only 88,549 engineers.
- Considering that the duration of the course is 5 years, we could have trained 184,282 engineers in the year, but we only managed 48% of that.
- We found a dropout or withdrawal rate of 52%. It is a worrying number with several causes, that we could consider:

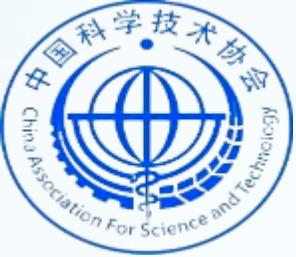




# Engineering Teaching in Brazil

- Low quality of basic education, with a great deficiency in the teaching subjects related to mathematics, physics and chemistry,
- Lack of teachers with better qualifications,
- Family economic problem,
- Difficulties in keeping up with an engineering course, which requires solid basic knowledge and a lot of effort.

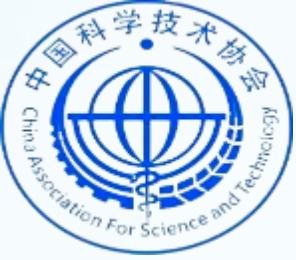




# Engineering Teaching in Brazil

- Analyzing the numbers referring to course completion, we see that last year Brazil graduated 15,482 architects, 11,689 agronomist engineers and 88,549 engineers of all other specializations.
- These are very low numbers. We could at least double those numbers so that Brazil could develop faster.
- It is very important to solve the problems listed.

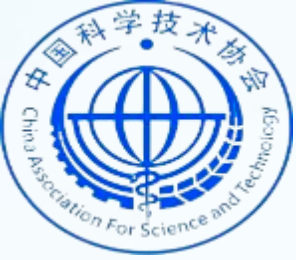




# Engineering Teaching in Brazil

- Another concern of ours is the general quality of the courses. We have good engineering schools, most of them public, but we find deficiency in teaching in many private schools, because they cannot maintain a structure adequate to the needs of a good quality school, and they cannot get more qualified teachers because of the low remuneration they offer .
- These difficulties are our greatest challenge.



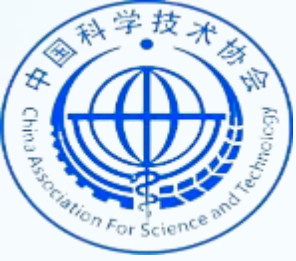


# Professionals in technical areas

- Quantity
- Distribution by specialization
- Distribution by region







# Distribution of Engineers by Specialization

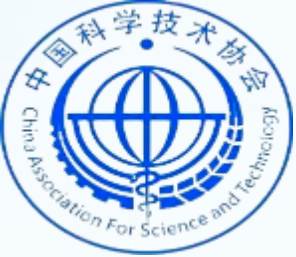
## ENGINEERS 855,142

|                      |         |              |        |
|----------------------|---------|--------------|--------|
| Civil                | 313,421 | Foods        | 5,870  |
| Agronomists          | 108,768 | Surveyor     | 5,679  |
| Electricians         | 110,602 | Metallurgist | 5,014  |
| Mechanical           | 105,432 | Mines        | 5,006  |
| Production           | 46,744  | Materials    | 2,869  |
| Environmental        | 31,846  | Petroleum    | 2,549  |
| Chemical             | 19,263  | Naval        | 2,054  |
| Control & Automation | 17,937  | Fishing      | 2,052  |
| Forest               | 14,401  | Aeronautical | 1,243  |
| Electronics          | 16,741  | Sanitarist   | 1,712  |
| Computer             | 6,700   | Cartographer | 1,708  |
| Telecommunications   | 6,443   | Others       | 21,088 |

## ARCHITECTS 165,322

Source: Federal Council of Engineering and Agronomy CONFEA and the Council of Architecture and Urbanism CAU-BR - 2017

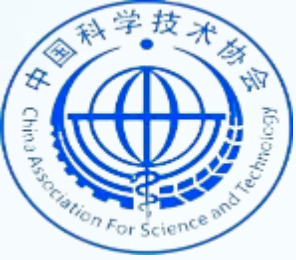




# Engineers by Region

| Region       | Population (MM) | Engineers (M) | %           | Engineers per 100M inhabitants | GDP per Capita (US\$M) |
|--------------|-----------------|---------------|-------------|--------------------------------|------------------------|
| Northern     | 17.9            | 50.7          | 7.8%        | 283                            | 9.3                    |
| Northeastern | 57.3            | 137.5         | 16.1%       | 240                            | 7.9                    |
| Midwestern   | 15.9            | 61.5          | 5.4%        | 387                            | 20.2                   |
| Southeastern | 86.9            | 480.4         | 56.2%       | 552                            | 21.3                   |
| Southern     | 29.6            | 125.1         | 14.6%       | 422                            | 18.6                   |
| <b>TOTAL</b> | <b>207.7</b>    | <b>855.1</b>  | <b>100%</b> | <b>411</b>                     | <b>16.1</b>            |

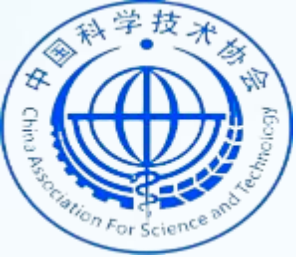




# Professionals in technical areas

- Here, we analyze the distribution of the engineers by the regions, and we compare it to the population, calculating the density, which is represented by the number of engineers per 100,000 inhabitants. Comparing this index to the GDP per capita of each region, we observe the proportionality between these numbers.
- For the largest number of engineers per 100,000 inhabitants, 552 in the southeastern region, we have the highest GDP per capita. Additionally, in the opposite case, for the lowest index of 240 we have the lowest GDP per capita.
- This proportionality between these data confirms that the development is directly related to the quantity of engineers.

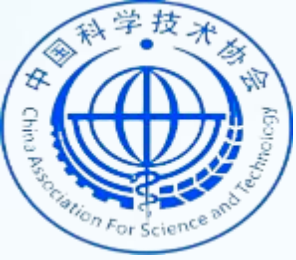




# Professionals in technical areas

- The only exception is the mid-west region due to the predominance of agricultural production, with its high productivity and profitability. This efficiency is a consequence of the scientific and technological advance of Brazilian agronomic engineering.
- To summarize, we have 855,142 active engineers in Brazil today, with an average index of 411 engineers per 100,000 inhabitants and we are graduating approximately 100,000 students per year.



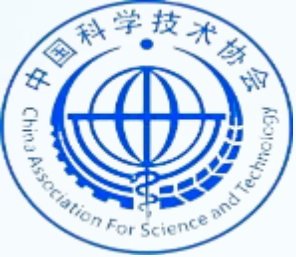


# Professionals in technical areas

- Of these 855,142 engineers, 108,768 are agronomists, who, together with 165,322 architects, form the Brazilian technological area's group of upper-level professionals that are responsible for the development of the country.
- These numbers could be bigger, and we are in a permanent struggle seeking improvement. Brazil is a developing country, and is part of the so-called BRICS, Brazil, Russia, India, China and South Africa.
- Our greatest struggle is development, and this development is wholly linked to the engineering capacity.

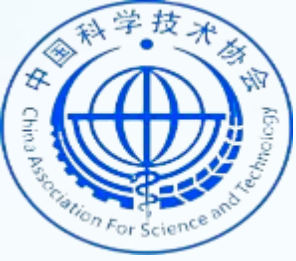






# Highlights of Brazilian Engineering Agricultural



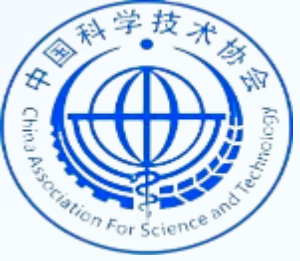


# Highlights of Brazilian Engineering Agricultural

- The evolution of our Agronomic Engineering places us among the largest producers in the world:
  - of grains (soybeans, corn, rice, wheat, etc);
  - of animal protein (beef, chicken and pork);
  - of coffee, ethanol, cotton and sugar.

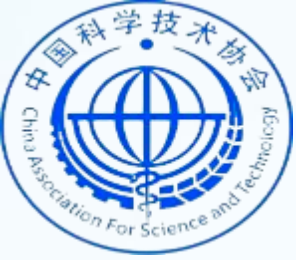






# Highlights of Brazilian Engineering Civil



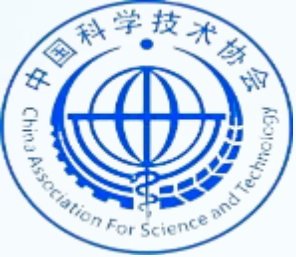


# Highlights of Brazilian Engineering Civil

- The development of our civil engineering, which designed and built important projects as:
  - Hydroelectric plants, in particular Itaipú, with its 20 generating units of 700MW each, totaling 14,000MW of installed capacity;
  - Bridges, viaducts, roads and buildings, not only in Brazil but also in several countries.

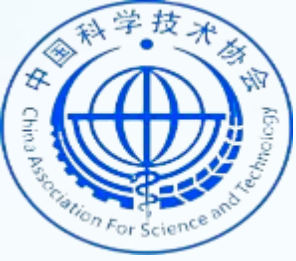






# Highlights of Brazilian Engineering Petroleum



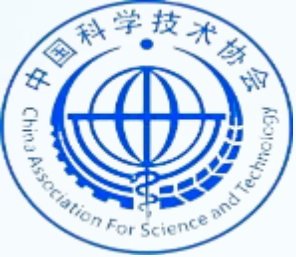


# Highlights of Brazilian Engineering Petroleum

- The development of petroleum engineering which stood out in the research and production of oil in deep waters, placing us among the largest producers in the world



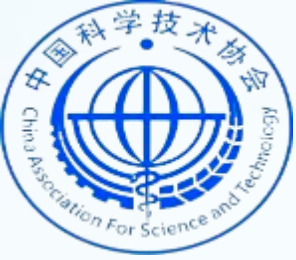




# Highlights of Brazilian Engineering Aeronautical



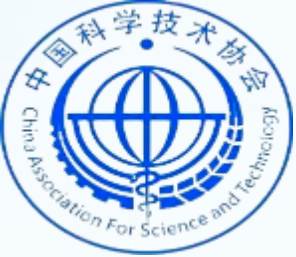




# Highlights of Brazilian Engineering Aeronautical

- Our aeronautical engineering has developed in such a way that, today, EMBRAER is the third largest commercial jet producer in the world.





# Thank you 非常感谢你

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