Jiachen Wang（Biography）

Jiachen Wang, born in January 1963, is the professor (second grade) and doctoral advisor in mining engineering in China University of Mining and Technology, Beijing. He is also the dean of college of Resources and Safety Engineering, the director of the Top-caving mining research center in coal industry in China and the academic leader of thick coal seam mining and ground control in China. Professor Wang's research and teaching interests are in ground control, thick coal seam mining, and rock slope stability.

Academic Contributions：

1. Ground Control Theory and Application Technology in Thick Coal Seam Mining

Top-coal caving mining method and large-cutting-height mining method are the efficient new technology to extract thick coal seams (>3.5m). Both of these methods have been employed and developed since 1980s in China. The large-cutting-height mining method applies to those that the seam thickness is 3.5m-7m and the coal has high strength. The top-caving mining method applies to those that seam thickness is 5m-20m and the coal has low strength, or the fracture of coal is well developed.

(1) Dynamic loading calculation on supports capacity has been proposed in thick coal seam mining

Top-caving mining method and large-cutting-height mining method have common characteristics: large mining height, severe overburden movement and dynamic loading impact on the shield, etc. There was not enough attention on the dynamic loading impact on the shield when determining the support capacity in the past. The dynamic loading is unapparent in the ordinary mining height（≤3.5m）. However, it is very obviously when using top-caving mining method and large-cutting-height mining method. Depends on the overburden activity for top-caving mining method and large-cutting-height mining method, the dynamic loading calculation on supports capacity has been proposed. The core of this calculated method is that the loading on the shield consists of the loading from the immediate roof and the dynamic loading from the main roof. The dynamic loading from the main roof equals to the loading on main roof multiply the dynamic loading coefficient. Suggested value of the loading coefficient was given for different roof structures and different mining methods (2009, 2015). This calculated method has been applied in Zhaogu Henan mine, Shanxi mine and so on.

(2) Binary criterion to determine support capacity for thick seams and ground control technology.

In top-caving mining method and large-cutting-height mining method, not only the roof dynamic loading, but also the destruction of rib is the main factor affecting the production efficiency and safety. Mechanical model of face shear failure was proposed. The main factors, which impact face shear failure, are the coal cohesion and roof pressure in panel face（2007，2009，2014）. Based on these approaches, a binary criterion was built to determine the reasonable support capacity and the shield design should balance the overburden pressure (2014). Thus, several engineering technologies were proposed: water injection in soft coal seam to improve coal cohesion of the face, reasonable shield design, higher setting force, shields advance timely to reduce the controlling area of the shield, coir rope grouting method to reinforce the coal face. These methods are successfully applied in the Xinxiang energy company in Jiaozuo Henan, Dayuan coal group in FengFeng, Ruilong Coal Group in Shanxi and so on.

(3) Theoretical model of roof breaking transference in great width panel face and new technology for dealing with hard roof.

For great width panel of large-cutting-height mining, the main roof breaks in the feature of subsection because of the existence of various structural planes and the change of supporting conditions. According to this situation, a transverse transference mechanical model of roof broken is proposed. It is the theoretical model of the roof sectionalized weighting. And a new technology has been developed to deal with the hard roof. This technology can induce the roof sectionalized broken by drilling the blasting borehole in the hard roof along the gateroad direction. This technology can reduce the dynamic loading impact of hard roof (2002). This technology has been successfully employed in Datong coal mine.

2. To Promote Top-coal Caving Mining Theory and Technology in China.

(1) Caving Mechanisms of Loose Top-coal has been created in Longwall Top-coal Caving Mining Method.

The loose top-coal theory has been proposed in 2002. And then, in recent 10 years, it has been developed and improved systematically. A series of articles has been published in《International Journal of Coal Science & Technology》, 2002(N.2), 2004(N.4), 2010(N.3), 2013(N.11); 《Coal Science & Technology》, 2013(N.1); 《Coal Engineering》, 2014(N.2); 《International Journal of Rock Mechanics and Mining Science》2014(N.2), etc.

The core of the theory is to establish of a unified research system of 4 elements which include coal-rock interface, top-coal drawing body, top-coal recovery ratio and the waste rock dilution. What's more, the self-developed top-coal tracking device and 3D physical simulation device can be used to verify the correctness of the theory. The theory also explained the coal-rock interface morphology and the impact by shield support and shield advance. A quadratic function fitting of coal-rock interface has been proposed. It divided the drawing body into three states: incomplete development, basically mature, and mature. According to the theory, due to the effect of shield canopy, the front of the drawing body develops faster than other parts, even beyond the scope of the ellipsoid. It has pointed out that the top-coal drawing body is non-ellipsoid which was cut by the shield canopy. So the concept of cutting altered ellipsoid is defined. The theory suggests that expanding the intersection range of coal-rock interface and drawing body to improve top-coal recovery ratio and reduce waste rock dilution. Thus, it is viable to improve top-coal recovery ratio by determining the reasonable caving technology and parameters and controlling the shape of coal-rock interface. The theory provides scientific guidance for improving top-coal recovery ratio and determining applicable mining thickness. Theoretically it indicates the top-coal loss, and the diluted location and mechanism of the waste rock. This is an important original theory in the area of top-coal caving mining reaserch.

(2)The top-coal caving technology has been promoted actively in thick seam of China by Professor Wang.

More than 10 Coal Mining Groups have been cooperated like Datong, Lu'an, Huaibei etc. Professor Wang has solved lots of issues in top-coal caving mining method like: caving issue, roof control, coal face control and other problems. He has made outstanding contributions to improve top-coal caving technology in hard thick seams, soft and thick seam , large dip angle thick coal seam. All these research results have played an important role in promotion of top-coal caving technology in China.

3. Academic Communication between China and International Mining on Ground Control.

(1) The International Conference on Ground Control in Mining (ICGCM) has been first held in China.

33th International Conference on Ground Control in Mining (China) has been held successfully in October 24-26 in 2014 in Beijing. More than 300 delegates who come from 10 different countries attended the meeting. Two proceedings both in English and in Chinese were published in this conference. The paper "History of the International Conference on Ground Control in Mining and Progress of Coal Mine Ground Control in china", which co-writed with Syd S. Peng, introduced the history of ICGCM in detail. It played a positive role in the promotion of ground control theory in mining.

(2) Professor Wang has been to ICGCM (2011,2014) where held in WV, Morgantown, Lakeview Resort. He made a presentation and detailed the thick coal seam mining technology and the development of ground control in China. He served as Chairman of one technical session in 33rd ICGCM (2014).

(3) Professor Wang has been to Australia (2000), Poland, Germany (2012) and other countries for extensive academic communication on Chinese ground control and mining technology.