1. Name: DR ARUN KUMAR SINGH

2. Date of Birth/Age: 45 years

3. Current Position and Address: (with E-Mail & Phone No.)

Principal Scientist
Strata Mechanics Section
Room No 17 (Main Building)
CSIR-CIMFR, Barwa Road Dhanbad, 826015 (Jharkhand)
Phone No. : 4333 (O)
Email : aksingh72@Yahoo.Com

4. Educational qualifications: (Graduation and above)

Sl. No.	Degree/ Certificate	Year of Passing	University/ Institute	Subjects
i	B. Sc. Engg.	1993	V.B. University, Hazaribagh/ BIT, Sindri	Mining
ii	M. Tech.	1996	IIT, Kharagpur	Mining
iii	PhD	2011	B.E.S. University, Howrah	Mining

5. Work experience

I joined CSIR-CIMFR in 1997 as scientist after completing M.Tech. from IIT, Kharagur and found myself comfortable in studying rock-mechanics during interaction of different mining structures with *in-situ* and mining induced stresses. I devoted last 20 years of service at CSIR-CIMFR in different investigations related to more than 100 in-house and industry-sponsored projects, including three S&T projects of the Ministry of Coal, Govt. of India and one collaborative (international) S&T projects. Details of different working posts/positions are given below in the table:

Designation	Institution/company	From	To	Nature of work
Junior Scientist	CSIR-CIMFR	August, 1997	August, 2001	R&D for efficient u/g coal mining
Scientist	CSIR-CIMFR	August, 2001	August, 2005	-do-
Senior Scientist	CSIR-CIMFR	August, 2005	August, 2009	-do-
Principal Scientist	CSIR-CIMFR	August, 2009	Till date	-do-

6. Area of specialization: : Strata/Rock Mechanics for Strata Control in Underground Coal Mining, Efficient Mining of deep seated Coal (Locked- up Coal in Thick Seams & Developed Pillars), Modelling and Simulation of Mining Structures, Underground Instrumentation and Monitoring of Strata.

7. Honors/Awards received:

- CSIR-Golden Jubilee CMRI-Whitaker Award, 2001-2002.
- Silver Medal of the Mining Geological & Metallurgical Institute of India in 2005-2006.

8. Fellowships/Scholarships:
   - Graduate Aptitude Test of Engineering (GATE) Scholarship, 1994

9. No. of Research Publications: Total : 74
   - Papers in journals: Thirty nine (Fifteen in foreign journals)
   - In conference proceedings: Forty four (Twenty one in international conferences)
   - Invited/key-note addresses:
   - List of best 05 publications:

1. S. Ram, D. Kumar, **A. K. Singh, A.** Kumar and R. Singh : Field and laboratory studies for an efficient placement of roof bolts as breaker line support. *International Journal of Rock Mechanics & Mining Sciences,* Vol. 93 (March, 2017), pp.152–162.
2. Rajendra Singh, Ashok Kumar, **Arun Kumar Singh,** John Coggan, Sahendra Ram: Rib/snook design in mechanised depillaring of rectangular/square pillars. *International Journal of Rock Mechanics and Mining Sciences,* UK., 2016, 84: 119-129.
3. **A. K. Singh,** R. Singh, J. Maiti, P. K. Mandal, and R. Kumar: Assessment of mining induced stress development over coal pillars during depillaring. *International Journal of Rock Mechanics and Mining Sciences,* UK., 2011, 48: 805-818.
4. R. Singh, **A. K. Singh,** J. Maiti, P. K. Mandal, Rashmi Singh and R. Kumar: An observational approach for assessment of dynamic loading during underground coal pillar extraction. *International Journal of Rock Mechanics and Mining Sciences,* UK., 2011, 45(1): 794-804.
5. **A. K. Singh,** R. Singh, M. Sarkar, P. K. Mandal and D. Sharma: Inclined slicing of a thick coal seam in ascending order – A case study. *CIM Bulletin,* Canada, 95(1059), 2002: 124-128.

10. Number of Books authored/edited:

- Reviewer of a paper submitted for publication in Geotechnical and Geological Engineering journal (International Journal).

11. (a) No. of Patents granted/applied for: Four

i) "A novel method for underground extraction of coal from contiguous seams/sections" by P. K. Mandal, R. Singh, T. N. Singh, B. K. Dubey and **A. K. Singh**: December, 2000.

ii) "A novel method for underground extraction of coal from a critically thick coal seam standing on pillars and the development made along the roof horizon" by R. Singh, P. K. Mandal and **A. K. Singh**: February, 2002.

iii) "A model for rib/snook design in mechanised depillaring under moderate roof strata" by R. Singh, **A. K. Singh,** S. Ram, A. Kumar, R. Kumar and A. K. Singh: November 2015. (*Patent application No. 3765/DEL/2015, filed by* CSIR-IPU)

iv) "A Method for Efficient Design of Breaker Line Support in Mechanized Depillaring" by Ram S., Singh R., Kumar D., **Singh A. K.**, Kumar A., Kumar R. and Singh A. K., 2015. (*Patent application No. 0244NF2016, filed by* CSIR-IPU on 10-01-2017).

Copy-rights

v) "Combined-Instrument-Approach (CIA) for analysis of underground instrumentation data." by R. Singh, P. K. Mandal, **A. K. Singh**, R. Kumar, A. Sinha, May 2009. (b) Technologies developed, Licensed and/or commercialized:

(b) Technologies developed, Licensed and/or commercialized:

My consistent involvement in different important geo-technical investigations in CSIR-CIMFR helped me in developing good understanding of geology and rock mass of Indian coalfields. It helped me in development of the award winning mining methods like - cable bolting based depillaring of thick seams, wide stall mining etc.; my recently developed mining methods like: "Underpinning based simultaneous extraction of contiguous sections under fragile parting" and "Cross development based underground extraction of a critically thick coal seam standing on pillars and the development made along the roof horizon" have added new dimension in the field of optimal underground extraction of thick and contiguous coal seams of the country. Development and application of a new process: known as "Combined instruments Approach" (CIA) for the strata mechanics proved to be an efficient method to improve safety of underground workings. Development of models for the design of rib and breaker-line support for CM based mechanised depillaring proved to be crucial for the efficiency of the mass production technology.

After laboratory validations (on simulated models) of different conceptual ideas, successful efforts are made to translate some of these ideas into large scale practice by the industry for optimal design of underground mining structures. My contributions to characterise rock-mass behaviour under changing stress conditions of mining proved to be significant for safe and efficient extraction of locked-up coal pillars. Coal mining industry of the country has widely accepted and acknowledged the techno-economical superiority of these R&D developments. These R&D efforts have earned considerable appreciations, large number of citations and prestigious awards too.

12. Foreign visits: Visited Czech Republic (Two times)

Czech Republic	03-May-2010	15- May-2010	Ostrava-Poruba	Participated in a joint research project under ASCR, Czech Republic - CSIR, India bilateral S&T Programme on "Rock mechanics investigations to meet challenges of strata control of deep underground coal mining" and interacted with scientists in 3rd Traditional International Colloquium on Geomechanics and Geophysics, at Hotel Sepetna Ostravice.
Czech Republic	21-June-2014	01-July-2014	Ostrava-Poruba	Participated in a joint research project under ASCR, Czech Republic - CSIR, India bilateral S&T Programme on "Rock mechanics investigations to meet challenges of strata control of deep underground coal mining" and interacted with scientists in Geo3M conference held at Institute of Geonics on 24.06.2014 and 5th International Colloquium held at Mountain Hotel Solan, Ostrava

13. Details of Professional memberships:

a. Mining, Geological and Metallurgical Institute of India	Life Member
b. National institute of Small Mines	Life Member
c. Institution of Engineers (India)	Life Member
d. International Society for Rock Mechanics and Tunneling Technology	Life Member
e. Mining Engineering Association of India	Life Member

14 . Major contributions: (Max. 150 words)

My personal R&D efforts and management skill resulted successful completion of different industry-sponsored projects, S&T projects of the Ministry of Coal, Govt. of India, some popular methods for safe and clean extraction of thick coal seams, appreciation from the involved industry, considerable number of publications in the best rock-mechanics/mining engineering journals/seminars symposium. I devoted last eighteen years of my services in different investigations related to more than 100 in-house and industry-sponsored projects, including three S&T projects of the Ministry of Coal, Govt. of India. My contributions are well proven and found to be of immense importance for excellence of production, productivity, safety and conservation. As per the feedbacks received from the industry, my developments have found perfect matching with the geo-mining conditions of our coalfields for techno-economic brilliance of the industry. I also initiated a collaborative R&D work with Institute of Geonics, the Czech Republic. Based on simple ideas and results of different field and laboratory investigations, my significant contributions are:

- Development of three *(two patented)* indigenous mining methods,
- Empirical model to estimate coal pillar loading under shallow mining conditions,
- Simulation and performance evaluation in field,
- Mechanisation and automation of underground instrumentation and monitoring and
- Design of different elements for Continuous Miner based mechanised depillaring.

15. Technologies and Products/ Services

(i) Developed: Developed following six *(four patented)* mining methods and processes for efficient and safe underground coal mining -

- ❖ Staggered development of a thick coal seam (already developed along roof horizon) for full height working in single lift by blasting gallery method.
- ❖ Underpinning based depillaring method for thick and contiguous seams/sections under weak and laminated partings.
- ❖ Cable bolting based mechanised depilaring method for extraction of thick and difficult coal seams
- ❖ Empirical model to assess nature and amount of mining induced stress development over the coal pillars during a depillaring operation and
- ❖ Rib/snook design in CM based mechanised depillaring under moderate roof strata.
- ❖ Combined-Instrument-Approach (CIA) for analysis of underground instrumentation data for strata dynamic study during final extraction.

(ii) Licensed:

(iii) Commercialized:

All the above mentioned methods/processes are extensively used and being used by the coal mining industry. Technical services related to implementation of these developments under the given site conditions have been rendered (in terms of sponsored/ consultancy projects) to more than sixty coal mines and most of them have achieved good success.

16. Designs and Prototype Developed:

Consistent devotion in my research activities in studying response of rock-mass for a redistributed state of stress and strain situation of the underground coal mining with widely varying geo-mining conditions helped me in developing good understanding of geology and rock mass of Indian coalfields. This helped me not only in development of above mentioned indigenous technologies but enriched my knowledge and understanding about the complete spectrum of uniqueness of Indian geo-mining conditions. This knowledge base and understanding enabled me to develop following designs and prototypes, in addition to the above mentioned methods/technologies:

- ❖ Adoption of suitable caving models under varying depth of cover and the nature of roof strata for efficient depillaring,
- ❖ Design of underground instrumentation pattern and monitoring frequency and
- ❖ Optimisation of design of roof bolt based breaker-line for a mechanised depillaring.

17. Honours and awards won for technological contributions or sociological impact of R&D:

- Silver Medal of the Mining Geological & Metallurgical Institute of India in 2005-2006.