



***STRAIN STATE ANALYSIS OF A LIMESTONE ROCK MASS
EXPOSED TO CHANGE DUE TO UNDERGROUND
EXCAVATION.***

**ANÁLISIS DEL ESTADO TENSIONAL DE UN MACIZO
ROCOSO CALIZO SOMETIDO A MODIFICACIÓN POR LA
ACCIÓN DE LA EXCAVACION SUBETRRÁNEA.**

SECOND PART



I- Goal Fulfiment of PDIC.

The general objectives of the Thesis, are:

II- Research & Results.

I. Status of the scientific research about of the rock mechanics applied in undergrounds works.

III- CONCLUSION.

II. Data procesing using a Matlab program.

III. Treatment of data obtained of monitoring the mine for a optimize the distribution of stress in rock mass.

LINE OF RESEARCH



I- Goal Fulfillment of PDIC.

II- Research & Results.

III- CONCLUSION.

➤ **Research Activity:**



👉 **Congress:**

- International Spain Minergy Congress 2015, conference: ***Analysis of the behaviour of the trajectory of rock fall in relation to modelling using the softwares.***

👉 **Papers:**

- Fracking, challenges and problems associated to its application, in Dyna journal (ISSN).
- Determination of Geometry and Measurement of Maritime-Terrestrial Lines by Means of Fractals: Application to the Coast of Cantabria (Spain), in Journal of Coastal Research (JCR).
- Economic Valuation of Mining Heritage from a Recreational Approach: Application to the Case of El Soplao Cave in Spain (Geosite UR004), in Sustainability journal (JCR).



Fuente: https://www.google.es/search?q=trabajos+geotecnicos&biw=1526&bih=1055&source=lnms&tbn=isch&sa=X&ved=0ahUKEwiPrvX72dzMAhXKAxoKHwCFCUoQ_AUIBigB#q=subsidiencia+minera&tbn=isch&tbas=0&imgsrc=tM1GYpTPauANgM%3A



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➤ **Research Activity:**



👉 **Projects:**

- I. The group of a R+D+i Cartographic engineering, Geodesy, Photogrammetry and Mine exploitation.
- II. The group of a R+D+i group of geotechnics.



I

II

- **Form Endesa company: Geotechnical advice to certain aspects of the expansion of a hydroelectric power station, in 2012-13.**
- **Competitive Project R+D+i in National call, with title: Critical distance in the breaking rocks (BIA2015-67479-R) (2016).**
- **Service geotechnical test and analysis.**
- **Vibration study for excavation work of the high school of Castro Urdiales for Siec S.A.**
- **Valuation of quarry Zierbana, through the market value of assets and adjustment to the business volumen.**
- **Seismographic report for the company Marmoles Baztan S.A., on the Quarry Alkerdi, located in Urbazubi/Urdaiz.**
- **Manageability report of concrete to section III of the "Y Vasca", in the city of Amorebieta-Etxano.**

Fuente: https://www.google.es/search?q=trabajos+geotecnicos&biw=1526&bih=1055&source=lnms&tbn=isch&sa=X&ved=0ahUKEwiPrvX72dzMAhXKAxoKHwCFCUoQ_AUIBigB#q=subsidencia+minera&tbn=isch&tbas=0&imgc=tM1GYpTPauANgM%3A



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➤ **Research Activity:**



MONITOR:

- 11 extensometers on the joins
- 8 extensometers of the anchor
- 6 station of convergence
- 2 cells pressure



Fuente: https://www.google.es/search?q=trabajos+geotecnicos&biw=1526&bih=1055&source=lnms&tbn=isch&sa=X&ved=0ahUKEwiPrvX72dzMAhXKAxoKHWcFCUoQ_AUIBigB#q=subsidiencia+minera&tbn=isch&tbas=0&imgc=tM1GYpTPauANgM%3A

👉 **Data to be analyzed:**

Módulo	Instrumentos	Canal	Sensor	Módulo	Instrumentos	Canal	Sensor
1	Ex-01	0	A	7	Ex-07	0	A
	Ex-01	1	B		Ex-07	1	B
	Ex-01	2	P		Ex-07	2	P
	Ec-01	3	Ec-01		Ex-08	4	A
2	Ex-02	0	A		Ex-08	5	B
	Ex-02	1	B		Ex-08	6	P
	Ex-02	2	P	8	Ex-anclaje-4	0	0,9
Ec-02	3	Ec-02	Ex-anclaje-4		2	1,9	
3	Ex-anclaje-1	0	0,9		Ex-anclaje-4	1	3,9
	Ex-anclaje-1	1	1,9		CP-1	4	CP-1
	Ex-anclaje-1	2	3,9		CP-2	5	CP-2
	Ec-03	4	Ec-03		Ec-06	3	Ec-06
4	Ex-anclaje-2	0	0,9	9	Ex-anclaje-7	3	0,9
	Ex-anclaje-2	1	1,9		Ex-anclaje-7	4	1,9
	Ex-anclaje-2	2	3,9		Ex-anclaje-7	5	3,9
	Ec-04	4	Ec-04		Ex-anclaje-8	6	0,9
5	Ex-05	0	A		Ex-anclaje-8	7	1,9
	Ex-05	1	B		Ex-anclaje-8	8	3,9
	Ex-05	2	P	Ex-11	9	H	
	Ex-06	4	A	Ex-anclaje-6	0	0,9	
	Ex-06	5	B	Ex-anclaje-6	1	1,9	
6	Ex-06	6	P	Ex-anclaje-6	2	3,9	
	Ex-anclaje-3	0	0,9	Ex-anclaje-5	10	0,9	
	Ex-anclaje-3	1	1,9	Ex-anclaje-5	11	1,9	
	Ex-anclaje-3	2	3,9	Ex-anclaje-5	12	3,9	
	Ec-05	4	Ec-05	Temperatura	13	AD592	



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➤ **Research Activity:**



MONITOR:
 11 extensometers on the joins
 8 extensometers of the anchor
 6 station of convergence
 2 cells pressure

👉 **Data to be analyzed:**

Módulo	Instrumentos	Datos	Módulo	Instrumentos	Datos
1	Ex-01	47.583	7	Ex-07	5.494
	Ex-01				
	Ex-01				
	Ec-01				
2	Ex-02	49.426	8	Ex-08	27.538
	Ex-02				
	Ec-02				
3	Ex-anclaje-1	4.706	9	Ex-anclaje-4	29.764
	Ex-anclaje-1				
	Ex-anclaje-1				
	Ec-03				
4	Ex-anclaje-2	5.085	9	Ex-anclaje-7	29.764
	Ex-anclaje-2				
	Ex-anclaje-2				
	Ec-04				
5	Ex-05	4.487	9	Ex-anclaje-7	29.764
	Ex-05				
	Ex-05				
	Ex-06				
	Ex-06				
6	Ex-anclaje-3	5.296	9	Ex-anclaje-8	29.764
	Ex-anclaje-3				
	Ex-anclaje-3				
	Ec-05				
				Ex-11	
				Ex-anclaje-6	
				Ex-anclaje-6	
				Ex-anclaje-6	
				Ex-anclaje-5	
				Ex-anclaje-5	
				Ex-anclaje-5	
				Temperatura	



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➤ Research Activity:

 Data to be analyzed:

LECTURA Y TRATAMIENTO DE DATOS PROCEDENTES DE LA MONITORIZACIÓN DE UNA EXPLOTACIÓN SUBTERRÁNEA DE CALIZA POR EL MÉTODO DE CÁMARAS Y PILARES

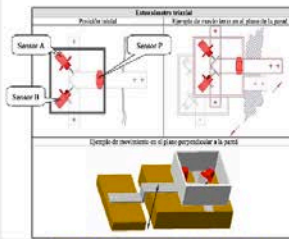
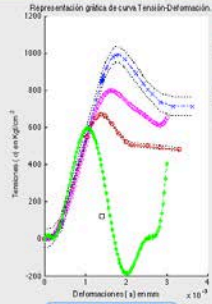


Figura 1: Extensómetro colocado en la mina.



Representación gráfica de curva Tensión-Deformación.

Seleccionar archivo de importación de datos y almacenamiento en variable global en el Worspace:

Importar archivo:

Simulación de curva de ensayos de rotura y de Mohr-Coulomb:

Ensayo de rotura

Variables del Ensayo a Compresión Simple:

Variable	Valor
<input checked="" type="checkbox"/> Peso Especifico en Tn/m ³	2,5
<input checked="" type="checkbox"/> Resistencia a Compresión Simple en Mpa	120
<input type="checkbox"/> Módulo de Elasticidad (E) en Mpa	No valor
<input checked="" type="checkbox"/> Módulo Transversal (G) en Mpa	42
<input type="checkbox"/> Coeficiente de Poisson (ν)	No valor
<input type="checkbox"/> Ángulo de Rozamiento Interno ensayo Compresión Triaxial en grados	No valor
<input type="checkbox"/> Cohesión Ensayo Compresión Triaxial en Mpa	No valor
<input type="checkbox"/> Tensión Tangencial Ensayo Tracción Indirecta en MPa	No valor
<input type="checkbox"/> Ángulo de Rozamiento Interno ensayo Tracción Directa en grados	No valor
<input type="checkbox"/> Cohesión Ensayo Tracción Directa en Mpa	No valor

Guardar datos

Tensiones (kg/cm ²)	Deformaciones (mm)
120	0.00140638



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THE STAGE LEFT TO COMPLETE THE MAIN GOAL OF THIS PHD THESIS IS THE DETERMINATION OF THE OPTIMUM ANTIFUNICULAR SURFACE ASSOCIATED WITH THE STATE OF STRESS FIELD OF EXCAVATION THE MINE.



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***THANKS VERY MUCH FOR YOUR
ATTENTION.***

