

Kelly Bars: technological evolution

Being always a prominent representative in the field of large diameter vertical drilling tool production, SIP&T continues to stand out as a leading company, able to manufacture innovative Kelly bars compatible with most of worldwide drilling rig brands



When competition on the market gets increasingly fierce, innovating and renovating are fundamental key words for manufacturer. To achieve these goals, however, is not easy and it presumes, availability to invest in research and development and, secondly, being able to count on consolidated skills and know-how, are equally indispensable requirements. Every new addition on the market is, therefore, the result of a wise mix of these ingredients, whose outcomes depend largely - especially in a sector as complex as foundations - on the ability to satisfy the needs of the final user, the best judge of a product's worth.

As reliable as steel

Young and motivated management team, wide range of products, fast services and high reliability are well-established features in a company like SIP&T, which has been in business since the '80s. The decade we are living in brings with it a series of generational changes giving a new look to the group from Campania, renewing its goals, market strategies and operating organisational methods. This way, the company has been able to quickly react to the changes that are remodelling the country's industrial structure. Even in 2013, the company was able to reach records figures for volume and turnover, focusing on two fundamental concepts: internationalisation and selection.

Today, the company's international dimension generates interesting figures and optimal prospectives. "We are structuring our network," explains engineer Francesco Cantisani, the Group's Sales Director, "to increase our presence on the international market. Working with foreign businesses is very stimulating and demanding, with an effect on costs that cannot be ignored. Just as true, however, is that foreign customers features are extremely interesting and very similar to our way of being in terms of reliability and extensive range. We have identified and signed sales agreements with businesses that have clear ideas, winning strategies and prospectives of growth. Setting up long-term collaboration models together has been our strategy over the last years: to the point that our first 50 customers have grown - in terms of



Kelly's solid model made by CAD 3D parametric Assigned material with mechanical and physical properties

share-of-wallet in the company - by nearly 50%. To reach this, SIP&T invests in training, organisation and systems, variables that are much harder to be imitated and replicated from competitors compared to a simple production plant. Thus, the barycentre has shifted from investing in production assets (as the facilities are already excellent) to investing in people and skills".

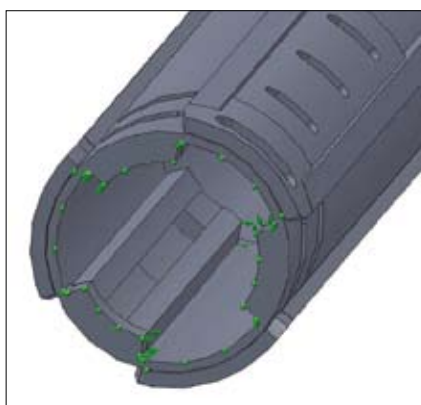
This renewed energy is also generational in nature: today, the group's entire management team is made up by people in their 40s. "We are a young group," continues Cantisani, "making this change enthusiastically, knowing that it's necessary to be able to grow. Obviously, the Campania company's new outlook cannot stray from guaranteeing products that are always at the top quality level. The wide range, which you can see on the company website www.sipdrill.it, is certainly one of our winning features: the know-how developed in over 35 years of experience allows the company to create excellent quality products, thanks to our ability to get to the bottom of



Boundary condition: Loads

the production process".

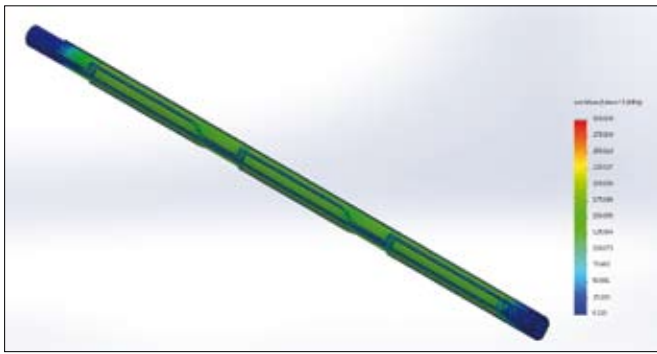
The range is wide and includes Kelly bars, tools for different soil/rock morphologies, casings, tremie pipes, Continuous Flight Augers, full displacement tools, stop end elements for diaphragm walls and, of course, all the spare parts necessary to use them. In addition, service quality is another essential ingredient for the Group's success. "Speed in answering market requests is an essential element. Don't forget



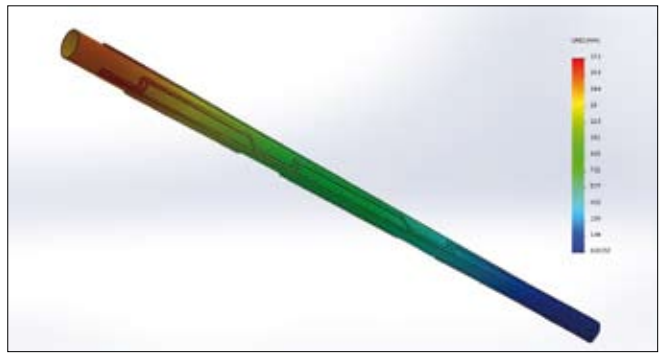
Boundary condition: Constraints



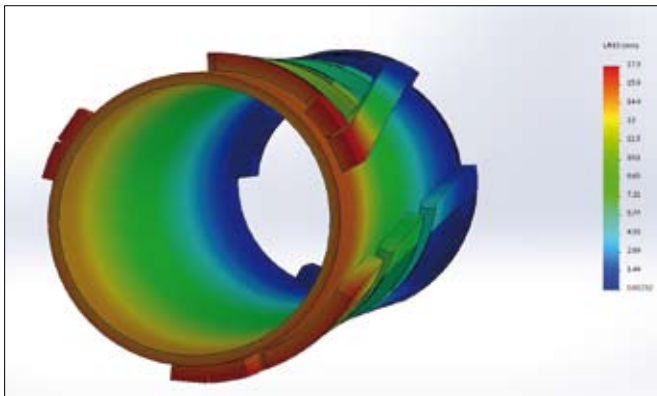
Discretized (Mesh) model



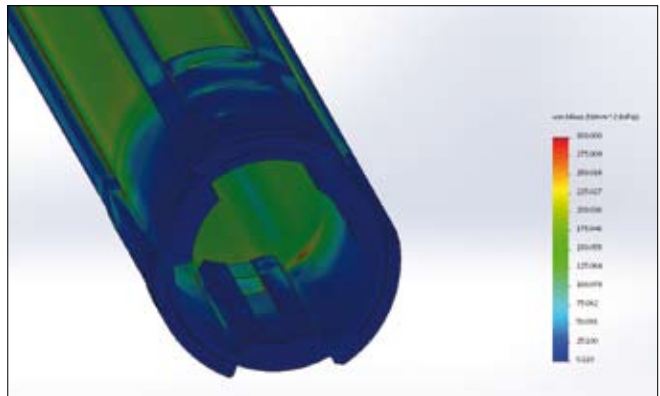
Von Mises Stress



Displacement along Kelly scope



Amplified Displacement along Kelly scope



Stress on terminal joint and along outer welded ribs

that the adjective 'urgent', conceptually speaking, characterises our job: that's why we're constantly investing whether in logistics and organisational efficiency. This is an aspect that allows us to get in touch with particularly structured companies that need fast response". The results are evident: in the last three years, the company has increased its annual turnover by 25%, in clear growth and bucking the trend compared to the general market.

Always cutting edge

The company's core business is, without any doubt, Kelly bar production (both interlocking and friction). Kelly bars transfer maximum torque and crowd force from rig to the drilling tool. Understanding customer requests, analysing reports from the different construction sites where SIP&T Kelly bars have been used, studying their performance in geologically challenging soil strata and checking their output, we decided to enrich and development company know-how by introducing the Finite Element Method (FEM) for each Kelly bar.

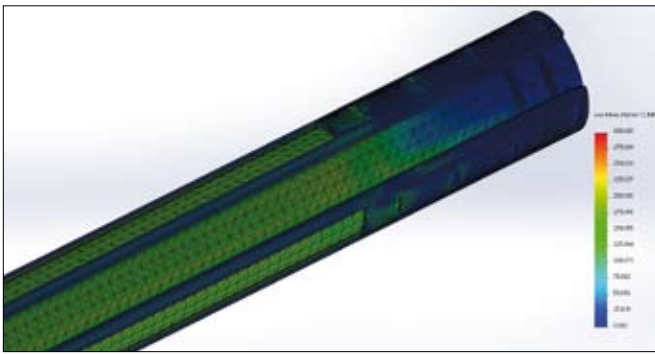
FEM is a numerical method that can be used to solve complex problems and today, has become the main method for structural

analysis. As its name suggests, it breaks a complex problem down into a finite number of simple problems. A continuous structure has actually an infinite number of simple problems but analysing the finite elements predicts the behaviour of a continuous structure via meshing into "finite elements", analysing a finite number of simple problems. Every element in a finite element analysis is one of these simple problems. Every element in a finite element model contains a finite number of nodes that define the boundaries of the element to whom loadings and bonds can be applied. The finer the mesh, the greater the number of nodes and elements and the more faithfully the structural geometry, load application, as well as stress and strain gradients can be represented. There is one compromise to live with: the greater the number of model nodes and elements, the greater the calculation power needed to solve the complex problem. Designing Kelly bars is essentially a repetitive process: a concept is developed, feasibility analysis is run, drawings are produced, prototypes are built and tested, the test results are evaluated and the process repeats itself until a version that can be made is found. FEM analysis is funda-

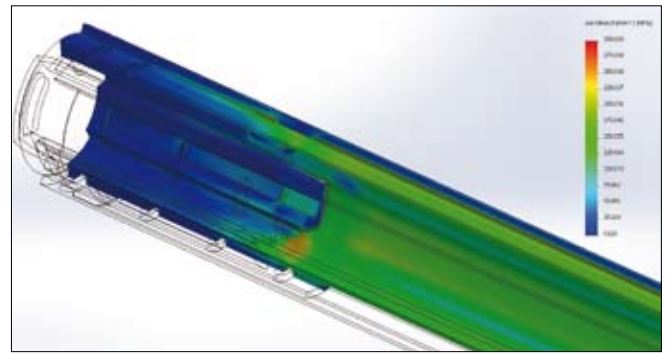
mental in facing and solving the challenges that come up during the various product development stages.

SIP&T has gained enormous benefits from implementing this analysis into its production process; in detail, the variety of materials used to build Kelly bars has been increased, optimised weight, thickness and shape, reduced testing time and, with it, time-to-market. The greatest advantage, however, is in the Kelly bar production stage, during whom we have noted a considerable reduction in the weight of the materials used, reduced material waste, reduced production times and, at the same time, increased production capacity and energy efficiency.

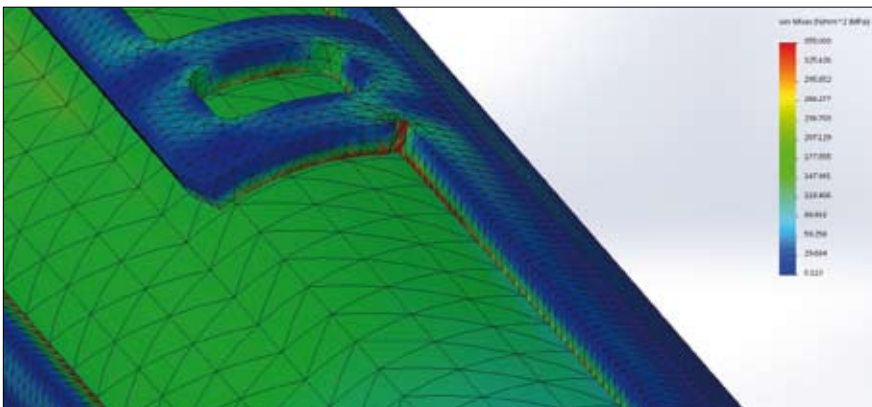
"From a commercial point of view," says Cantisani, "we have recorded a remarkable increase in demand and price-quality ratio by differentiating the product. The outstanding feedback from construction sites have confirmed improvements in Kelly bar behaviour and have, therefore, strengthened customer loyalty. We have increased the number and types of Kelly bars on the market, almost completely eliminating the cost and number of Kelly bar returns due to breakage or design flaws". All of this allows us to quickly (two-



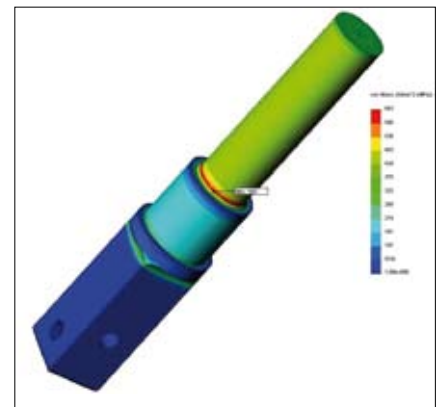
Stress on terminal joint and its welded pipe



Stress on inner welded ribs



Stress on Lock Device



Stress on Drive Stub

three weeks) supply the final user with the finished equipment, built in accordance with the drill torque and the project features of the pile to drill. To date, SIP&T designs and produces the right Kelly bar compatible with the related rotary head for all major drill brands and models. The torque range to keep in mind is vast and goes from a minimum of 40 kNm to a maximum of 480 kNm; the maximum reachable depth is up to 100 m. To this end, remember that the maximum length of a telescopic Kelly bar (consequently, its drilling depth) and its ability to drill the soil depend on three factors: the type of drilling rig, the winch pulling capacity and the type of tool used.

SIP&T can customise the length of the Kelly bar, the number of its elements, the rotary drive passage, the drive stub, the kelly guide flange, the swivel joint with the wire steel cable, the upper and lower shock absorber systems, the profile and pitch of the lock and unlock systems on the different elements, as well as the drive shell on specific customer requests. Perfect Kelly bar sizing requires studying of soil geological report, precise knowledge of the maximum torque that can be applied to the Kelly bar, the suitable tool

to advance quickly and safely. Upstream of all of this is proper FEM analysis that considers all the previously mentioned parameters plus the mechanical features of the materials used. This way, the parts of the Kelly bar that are more highly subjected to stress are identified and, therefore, the product design starts from pipe quality, diameter and thickness, as well as from the width and thickness of the ribs to weld onto the pipes to stiffen them, ending up with the right tolerance between the various elements making up the Kelly bar itself. Special attention is given to sizing the drive shell, which transfer rotary drive and crowd force between an element and the next one. This is a delicate aspect and, more often than not, defines a successful Kelly bar. In general, dimensional checks are done during the production process, using go/no-go gauges and non-destructive testing with liquid penetrant and ultrasonic flaw detectors to check welding efficiency. The materials used are high quality and certified according to international standards; they are chosen following engineering criteria including, for example, high resistance to wear. Modern CAD/CAM tool machines allow complex mechanical process-

ing. Innovative welding processes ensure a reduction in defects and, therefore, extend the Kelly bar's useful life. "Increasing company profits while reducing costs and improving product quality," concludes Cantisani, "is common knowledge. The competitive environment we are in daily is awarding us, given our ability to reduce delivery time, the efforts, the prototypes, the physical testing, the repetitions and the expenses connected to this iterative process. Analysing and testing our Kelly bars on a computer using FEM analysis is proving to be an excellent tool to reduce the time to market, decrease development costs and improve product quality".

INFO



SIP&T S.p.A.
Via G. Agnelli 6
84081 Baronissi (SA) - Italy
Phone +39 089 9566338
info@sipdrill.it
www.sipdrill.it