DELMIA

Making Shipbuilding Fast and Simple!

Creating a robot program of hundreds of meters of weld should be fast and easy. Manual programming, on-line, though, would take days, whereas completing it off-line would only take an instant.

DELFOI

To accomplish the programming task of a huge arc welding robot at a shipyard has posed an immense challenge since the robots were introduced into the shipyards. Pemamek (www.pemamek.com), a leading supplier of arc welding automation systems for shipyards, and Delfoi (www.delfoi.com), business partner to DELMIA, have developed a superior off-line programming (OLP) system based on DELMIA IGRIP software. The IGRIP Shipbuilding Application is easy to use and fast in generating complete arc welding robot programs for a gantry type of robots. The application is for both flat and curved blocks in a ship steel structure.

Understanding the ship welding process and robot off-line programming

It takes software development skills and a deep understanding of the robotized ship block welding procedure to develop software for a unique process in this industry segment. Delfoi's and Pemamek's union is a perfect match of software and process know-how. Pemamek, with products found in 40 countries and all continents, has delivered several robots to shipyards globally. Twenty-five years of experience in arc welding and state-of-the-
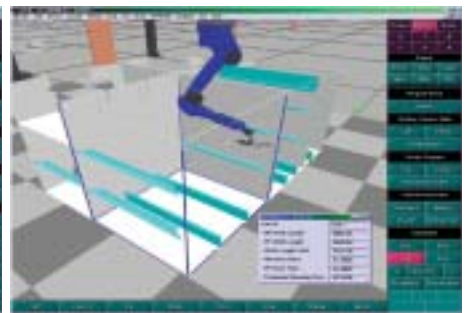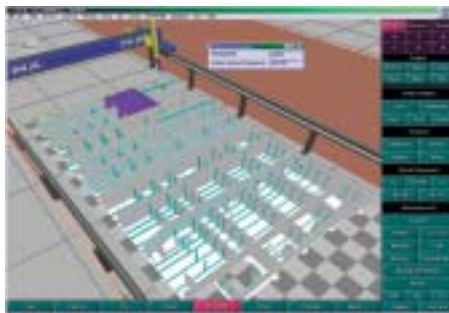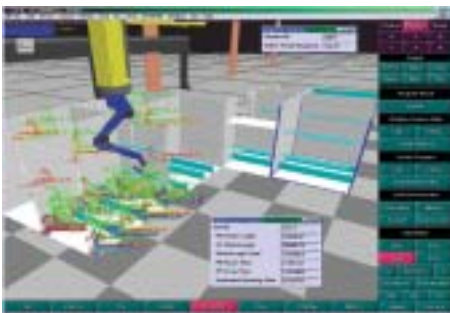

Pema gantry welds a ship structure

art robot off-line programming has laid a solid foundation for the co-operation. Co-partner Delfoi has more than 14 years of experience in delivering customer-tailored DELMIA IGRIP off-line programming applications. The first IGRIP arc welding application was implemented in Finland in 1990. Since then, Delfoi has delivered more than 60 IGRIP arc welding applications to more than 50 different companies.

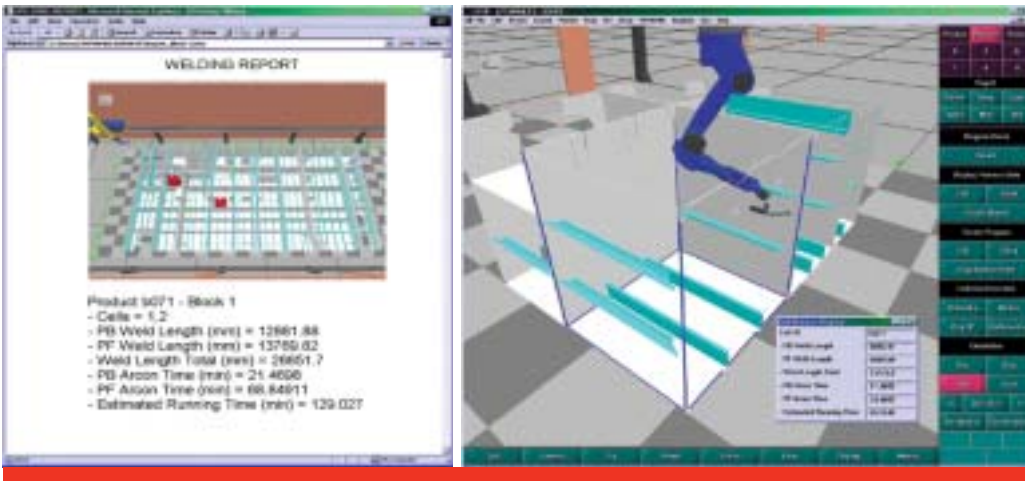### State-of-the-art robot off-line programming of ship structure

Everything is big in a shipyard. Along with the mammoth robot stations, it is not unusual to find 300 meters or more of weld in a ship block structure. A gantry robot can have traveling lengths of even 200 m! Nowadays everybody understands that on-line teaching of welding paths is not a viable option. OLP is an effective tool for generating robot programs at the shipyards when it comes to the welding of complex 3D blocks.

There are both graphical and non-graphical OLP tools on the market. Non-graphical systems are based on large welding procedure databases and rules. They lack the ability to check the robot system for collisions beforehand, and reachability.

They are also very inflexible in terms of product type changes. Graphical, model-based systems, on the other hand, possess the capability to collide and check reachability. Graphical systems differ from each other in how they carry out the collision checks and benefit from weld part features. Collision checks can be interactive, as with IGRIP, or based on collision avoidance algorithms as with some other systems. Graphical OLP systems benefit from features and topology. They differ from each other mainly on the level of how the programming is automated. This is the state-of-the-art shipbuilding OLP applications utilize, so-called "restriction rules," when they generate a robot program for a pre-set block feature and

Loading workcell and product model

SHIPBUILDING

Process documentation

robotic welding systems. At the end of the day, it is a question of how much welding consumables were used by the robots per shift and how much the customer has invested to achieve this. With solutions offered by Pemamek and Delfoi, customers can be sure that their robots are competitive compared to any other solution on the market today.

configuration. The creation of programs is automated to a large extent.

IGRIP Shipbuilding Application – Technical Features and Workflow

To challenge the existing leader vendors, newcomers must override the 'benchmark' features of existing state-of-the-art software. Before starting the development of the new IGRIP Shipbuilding Application, Pemamek studied the current status of OLP tools used in shipyards and gained profound understanding about what should be done in order to better serve customers. For example, in the handling of CAD data, controlling robot program length and welding parameters were re-evaluated and new practical approaches were introduced.

The IGRIP Shipbuilding Application generates a complete ready-to-go robot program for a flat block area of 14m x 20m in just a few minutes. The main features of the system are:

- robust and flexible use of CAD geometry
  - Segment-based visibility control of the block
  - Ignore sections of the ship block that do not yet exist in the robot programming phase
- semi-automatic block calibration utility
- cell- and block-oriented programming, program-size balancing
- enhanced arc welding macro-programming
- automatic path creation for finding start and end for the joint
- automatic creation of robot program
- automatic collision recovery routine
- advanced process parameter handling
- process report functionality

Steps of a typical workflow when creating a complete robot program are:

- importing of CAD data
- creating welds for a selected cell(s) by using enhanced arc welding macro-programming
- automatic creation of seam-searching routines
- selecting cells for a program block and automatic program creation
- process simulation and collision analysis, automatic correction if necessary
- process report, which includes PB and PF weld lengths, arc on times, estimated running time, etc.
- calibration of the real block on the shop floor
- downloading program to the robot controller and program execution

Pemamek will provide the new system for the major shipbuilders globally

Pemamek has been developing programming solutions for robotic welding stations for the past few years. They brought an unbeatable robotic solution for welding micro-panels, flat panels and small parts to the market. This solution is based on the use of machine vision, eliminating the need for CAD models. However, with complex 3D structures, such as double bottoms or curved panels, the right solution is to use OLP software. The IGRIP architecture allows us to utilize the right level of automation during the different phases of the programming, giving customers both a flexible and safe choice. The main feature on all the Pemamek systems is the practical and easy-to-use approach to the welding task at hand. This in turn guarantees incredibly short start-up periods and high utilization ratios of the

About Pemamek
Pemamek Oy Ltd specializes in industrial work-piece handling, welding mechanization and automation, which has carried out work on behalf of the productivity of its clients for many years. Their clientele includes enterprises from machine shops to shipyards, and from windmill manufacturers to power plant builders.

Pemamek operates in international markets with products in over 40 countries on every continent. Their main international collaborative partner is Esab. For over 25 years, this partnership continues on the part of both marketing and welding technology.

Information about Pemamek at
www.pemamek.com

About Delfoi
Delfoi develops, markets and supports Digital manufacturing solutions and related consulting and integration services for the Product and Process Lifecycle Management (PLM). Delfoi has a 14 year partnership with DELMIA as a reseller and development partner.

With Delfoi products and services, companies can plan and manage their order-based-manufacturing and delivery processes, which will lead to shorter time-to-market, faster ramp-up, shorter lead times, less inventory and better delivery accuracy.

Information about Delfoi at
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POWER to PLAN is POWER to BUILD