Factories of the Future

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control units. Plans call for the Tianjin plant to be as big as small trucks, switching cabinets, and grown man are built here, as are wind turbines extremely imposing. Electric motors the size of a (SEDL) motor production facility in Tianjin, building, the Siemens Electrical Drives Ltd. arrangements, component transport routes, the risks associated with transferring are from real machines. The models are used in calculating optimal machine Siemens experts simulate new factories on computers long before anything is planned and built from the ground up within the proper degree of abstraction. "If you’re simulating material flows to come up with a layout, you don’t need to have everything down to the smallest bolt — but you do need this kind of information for complex assembly simulations," Korves explains. Korves did in fact have to get very detailed in another project he worked on with Siemens VDO that involved production of a new vehicle dashboard. The job required detailed depictions of manufacturing cells as a means of simulating their ergonomic properties. Here, CT used software from UGS, which is now part of Automation and Drives (A&D) and is known as Siemens PLM Software (A&D PL — see p. 16). The software utilized standard values to record the size and stature of a worker and the number of times he or she repeated certain move- ments. This made it possible to optimize work-
nical University, the team came up with Plant Calc, a sophisticated planning tool. Plant Calc software can compare production locations us-
ing a systematic assessment of various alterna-
tives, which also takes into account planning uncertainties. In a study conducted by CT for a Siemens plant in northern Germany, Plant Calc determined that under certain conditions, ex-
panding production in Germany would be bet-
ter than transferring it to Eastern Europe. The
study found that although wage costs in Ger-
many are higher, the potential for optimization
in the country made it a more economical pro-
duction location.

True-to-life Virtual Testing. Reality and the
virtual world are moving closer together at
A&D, which operates two “SmartAutomation”
research centers in Nuremberg and Karlsruhe
that will be used to develop automation solu-
tions virtually and in real life. Researchers have
set up a bottling facility in Nuremberg and a
chemical processing unit in Karlsruhe, both of
which enable new ideas to be rapidly imple-
mented in actual equipment for the first time.

Among other things, researchers are now
building a robot that grabs bottles as they pass
by, takes them to a quality control station, ex-
amines them, and returns them to exactly the
right spot on the production line.

All of this was planned and tested in the vir-
tual world. To do so, A&D developers inserted
the virtual robot into its future real position in
an image of the existing facility. All bolts,
measurements, electrical connections, data
communication and pressure systems were
verified before actual implementation. The re-
searchers even ran a realtime simulation of the
robot’s operating parameters. On the other
hand, the initial data entered into the system
for simulating the bottle-picking robot came
from the physical bottling unit. “The fascinat-
ing thing about SmartAutomation is that you
can directly link reality and a simulation,” says
project manager Bernd Ogennoorth.

Despite the excellent performance of the sim-
ulation system, there is still room for im-
provement, especially with regard to the com-
prehensiveness of the planning process. That’s
because data from the entire process chain
does not pass seamlessly from the first draft
design to the finished factory model. In many
cases, data has to be transferred manually from
one program to the next — for example, from a
3D drawing to the visualization software, or
from a virtual model to the language used by a
computer controlled CNC milling machine.

“What we need to do now is eliminate the discontinuities and automate the transfer of
data from the beginning to the end of the
process,” says Ogennoorth. Researchers from
his team are working with A&D PL to solve this.

Lego for Factories. A similar approach is em-
ployed by the “SmartFactoryKL” project man-
aged by the German Research Center for Artifi-
cial Intelligence (DFKI) in Saarbrücken. The
center is a consortium of companies and re-
search institutes that is also working on a
miniaturized version of a real production facil-
ty. A founding member of the consortium,
Siemens A&D also provides funding for the
SmartFactory, which, like SmartAutomation,
simulates production in the virtual world. One
of the factory’s purposes is to demonstrate
how components from different manufacturers
can be combined. It’s a visionary idea that fore-
tells future factories built from standard mod-
ules much like giant Lego blocks. This would re-
quire that each producer’s modules be
equipped with standard interfaces.

In addition, all SmartFactory plant compo-
ents for the miniaturized production facility
are to be equipped with radio frequency ident-
fication labels (see p. 92), thereby making it
possible to automate inventory registration
and precisely pinpoint machine locations. This,
in turn, will make it easier to expand or convert
existing factories. Machine locations could be
fed into virtual models to enable planners to
determine exactly where new equipment
should be installed. “A lot of work — and infor-
mony — goes into virtual factory models,” says
Dr. Oliver von der Linden, coordinator, Eric Pohlmann.
“Not only does it take time, but it’s also critical for the system to always
make the most of the given data. This means that we have to be
able to use the data to plan the factory from the beginning to the end.”

Planning and designing technically sophisticated products was,
until recently, a long, drawn-out process. Today, however, Siemens relies on
digital product development, which involves planning all steps — from the first model sketches to proto-
types — in virtual reality. This makes it much easier for experts to coordinate
their activities and often shortens the product development process by months.

Mail sorting machines have an insatiable appetite. In just one hour, they
can process up to 40,000 items, which fly through their sorting gates at lightning speed, whereby
soft pressure is applied at each gate to send en-
velopes along on their proper track. A rigid en-
velope, for instance, one with a CD inside, can
do great damage in such a high-speed system,
as it can get stuck in one of the gates, causing a
huge backlog of hundreds of letters in just a few
seconds. The machine then has to be shut off,
resulting in costly downtime.

Giant sorting units are therefore equipped with
precision mechanical instruments for
measuring letter stiffness. Like a small finger,
such instruments briefly tap each letter to
measure its resistance. Envelopes deemed
to be too rigid are removed before they can cause
damage. The stiffness measuring instruments
have to be both sensitive and fast in order to be
able to touch each envelope as it flies past
without damaging it.

Around a year ago, engineers responsible
for the production of sorting machines at
Siemens Industrial Solutions and Services’ (I&S) Postal Automation division in Konstanz, Ger-
many, found that they needed a particularly