aquatune

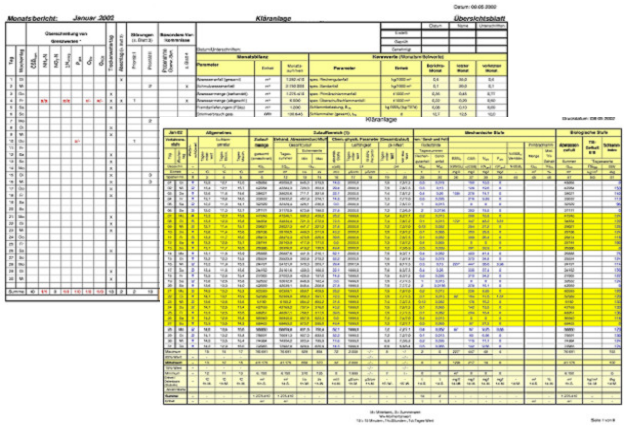
aquatune - Dr. Gebhardt & Co. GmbH

Intelligent Optimization of Water- and Wastewater-Processes!

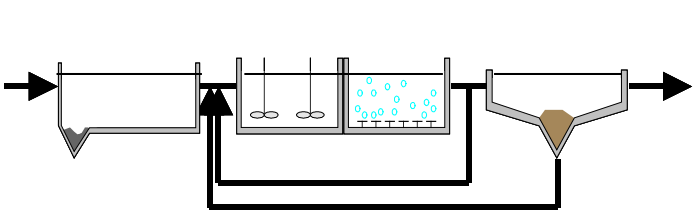
Where different disciplines meet, something new can rise. We have combined the technologies of artificial neural networks and genetic algorithms with processes like water treatment, water distribution and wastewater treatment plants. The result are solutions, which make model based optimization of plants economically highly attractive. The reduction of pollutant loads for the environment and at the same time saving effort and costs is our target!

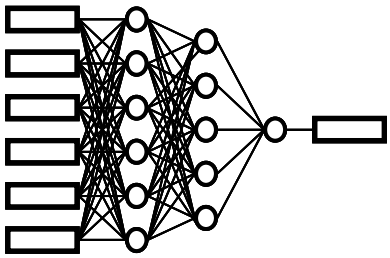
Our Slogan:

From data - graveyards...



... to optimized plants!





Who Are We?

The company aquatune was founded as GmbH (LLC, limited liability company) and is part of a powerful network. All founders and employees of aquatune have many years of professional experience in automation and optimization of technical and commercial processes. We are driven by the idea of optimizing processes by the application of technologies, that make optimizations feasible, that up to now have not been optimizable in an economically meaningful manner.

Our Business

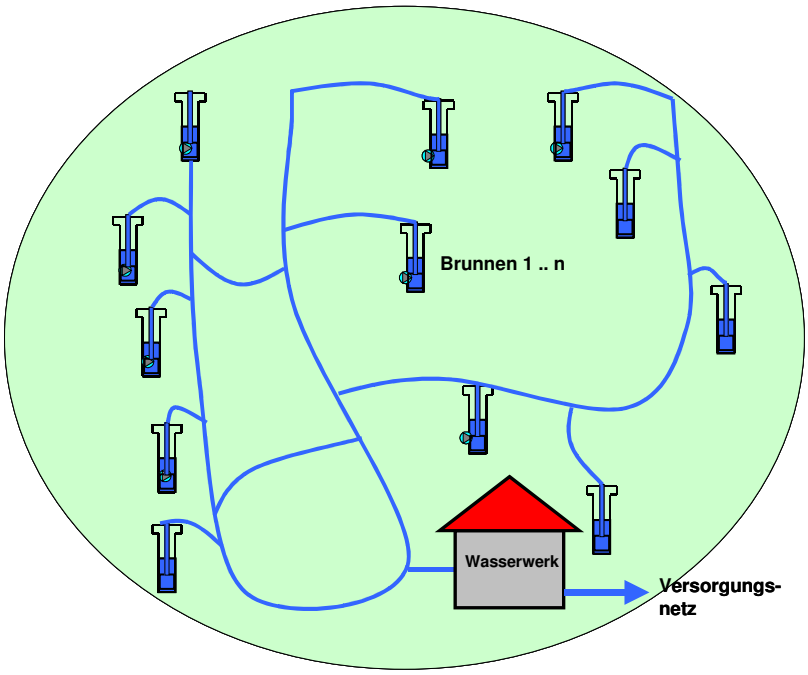
We are engaged in the development and marketing of products and services in the realm of optimization of processes.

We do optimization of all water processes, from the well to water treatment and water distribution to the wastewater treatment plants.

The situation in germany (and other well developed countries) is characterizd by the fact that nearly no new plants are built. But in the operation of existing plants there are significant potentials of saving resources and money. These potentials can be realized by the application of “intelligent” operation. In addition laws become more and more strict about the compliance to strict threshold values.

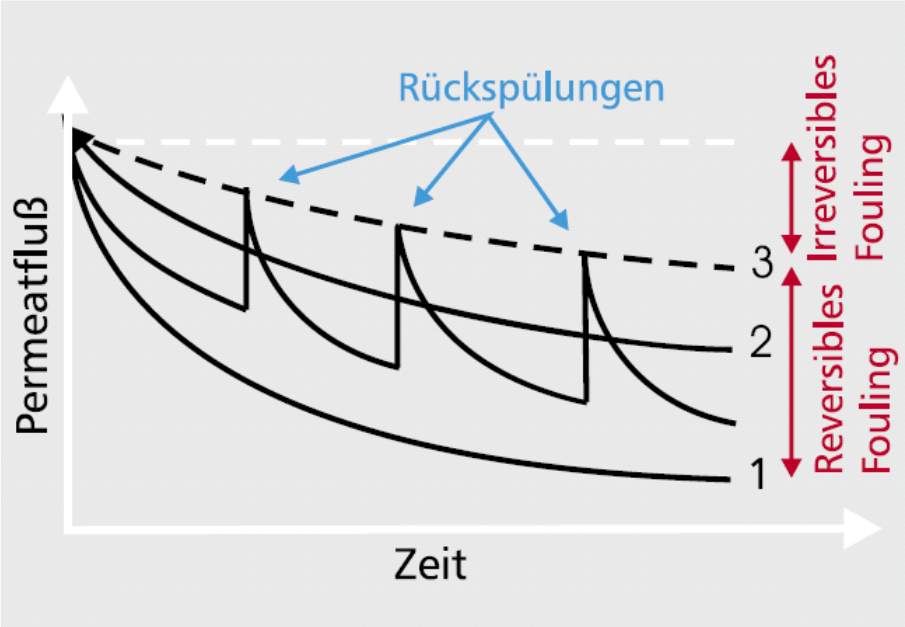
Control of a System of Wells

The control of a networked system of wells with different yields to cover a specific demand of raw water is not a simple task. A (neural) model of the well system in connection with a genetic optimizer can master this challenge.



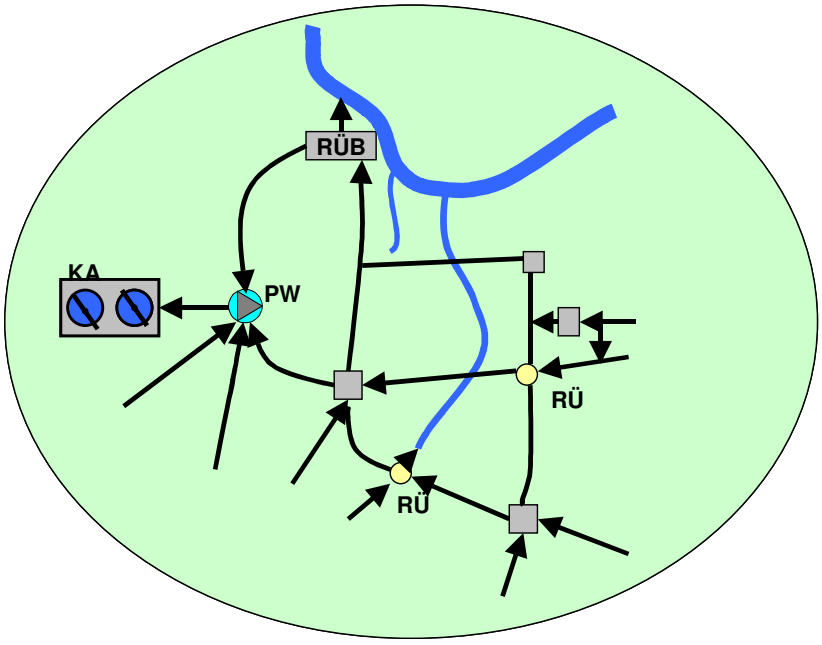
Water Treatment (Example: Membrane-Filtration)

A membrane filtration plant must be backwashed on a regularly basis in order to keep ist functionality and performance. The challenge is, to control the timing, frequency and intensity of the backwash procedures in such a way, that the productivity of the plant is at an optimum level and at the same time, costs for energy and chemicals are minimal.



Sewage Water and Rain Water Distribution

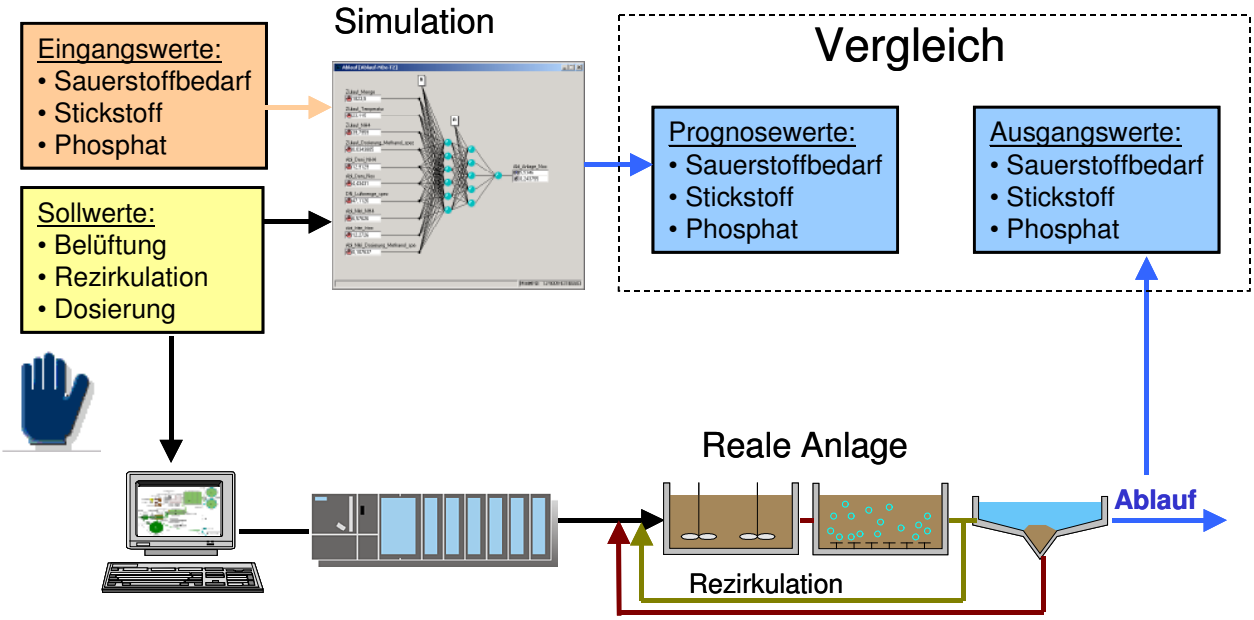
In many sewerage systems the existing buffering capacities could be much better used, when they would not be fixed but could be adjusted and controlled in an intelligent way. By this means many thousand tons of discharge of untreated water into the receiving



water course could be prevented.

Waste Water Treatment Plants (WWTP)

The safe compliance to threshold values and at the economically applying energy and chemicals (precipitation, coagulation, flocculation, carbon sources …) is a big challenge for a human operator. Solutions on the basis of physical modells are not widely available, because of the effort to develop them and because of their complexity.



Are we even dealing with a packed bed process, the usual control strategies based on the measured of oxygen concentrations and/or redox potentials fail, because those parameters cannot be measured in this kind of plants. Here the application of the “data-driven” method of artificial neural networks (ANN) can help significantly.

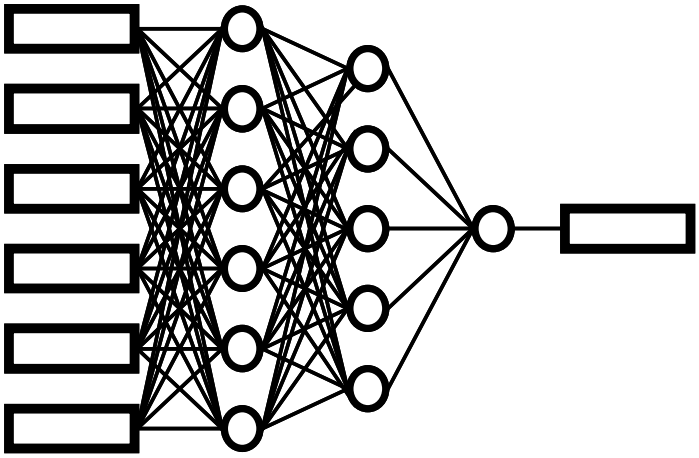
Technology

In the realm of water- and wastewater-treatment there exist a number of processes with high complexity, like for eaxample the biochemical degradation processes in the activated sludge stages of modern sewage treatment plants. These processes are either not well enough understood or the the resulting models are very complex (many mathematical equations, even more parameters). Therefor these processes are nowadays controlled by simple controllers, experience and plausability strategies. Sometimes this works amazingly well. But the qality of the achieved results depends strongly on the experience and commitment of the involved staff. Also from time to time high load situations like for example during wine campaigns in the autumn months can lead to outliers if not even overflows.Since the plants do not operate at the possible optimum we also have excessive consumption of energy and chemicals. The need for better methods of controlling such plants exists doubtlessly! The solution is the application of software technologies that were developed to deal with complexity: Artificial Neural Networks, Genetic Algorithms and Fuzzy Logic. And this y all means in combination with conventional methods of control technology and statistics.

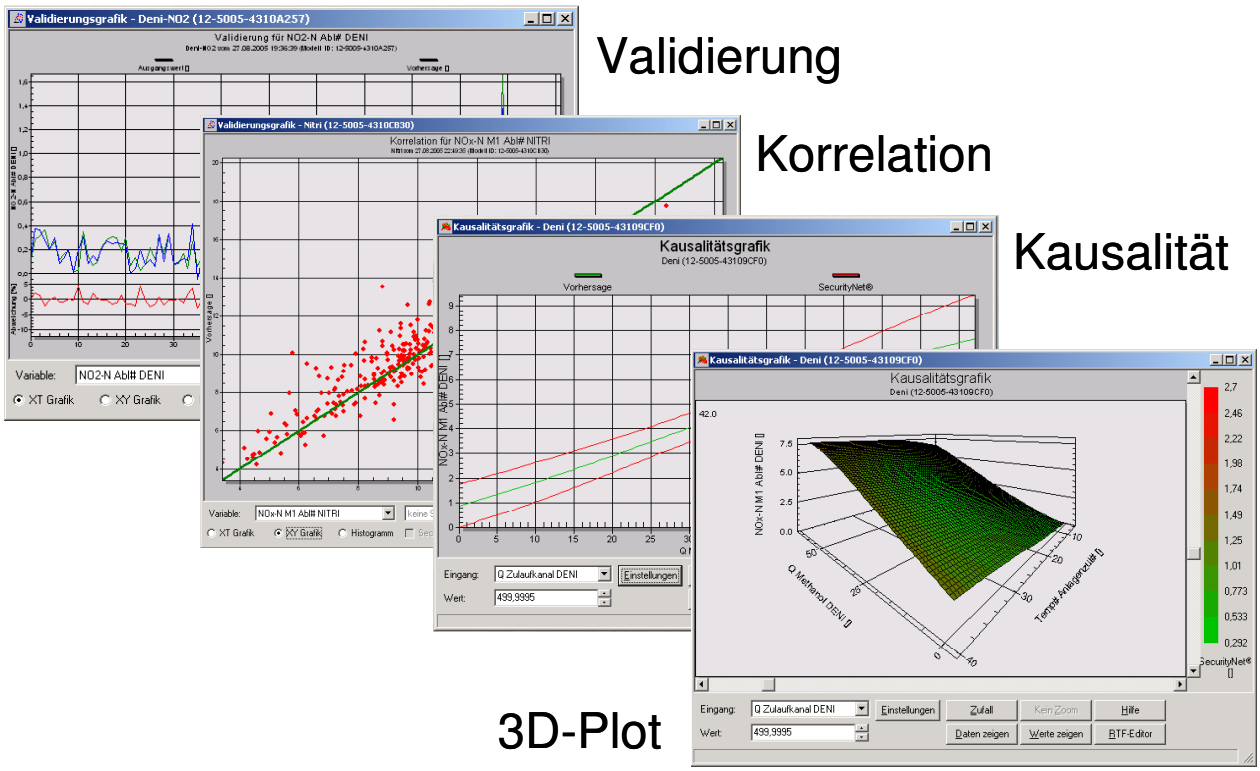
Neural Networks

Artificial Neural Networks (ANN) derive their name from from the analogy to the features of a human brain. They are a mathematical construction (network) that consists of a nearly arbitrary complex, non-linear function, whose parameters can be varied by an

iteratively working “learning algorithm” until a desired behavior of the network results. When input informations are applied to the ANN it responds with an output information. Has the ANN been trained to behave like a certain technical process, the ANN can be called a model of the process. Usually this model will be used to generate forecasts.

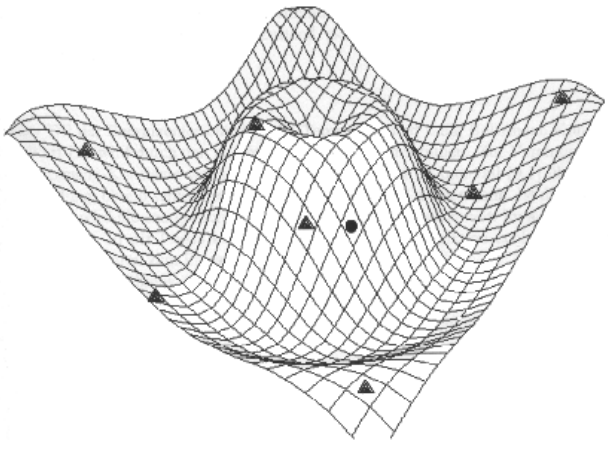


ANN´s are said to be intransparent “black boxes”. There´s some input and some output, but what the internal synapses and neurons do cannot be interpreted by humans, because the contexts of the processes are located in the many different parameters of the network. Therefore we have developed very powerful tools to screen the resulting models in all dimensions. From validation to correlation analysis, various statistical analysis methods, causality analysis to three-dimensional sectional views of the state space make the model as transparent as one wishes. Many experts have already been surprised and had to revise their process understanding after NeuroModel had proven the opposite of their opinion…



Genetic Algorithms

The Genetic Algorithms derive their name likewise from the analogy to nature. This time it is our imagination of evolution. Concepts like mutation and selection are mimicked by mathematical methods, that can be used to find solutions. They have advantages whenever the analytical search for a solution is too expensive due to the complexity of the problem.



In connection with an ANN as model of a technical process we can apply Genetic Algorithms (GA) to find a set of adjustment parameters for a process, that complies to a given target function. This target function could for example be: find a set of parameters that leads to compliance to threshold values minus 15% and reduces the consumption of methanol and Fe(III)Cl.

The values, that are found by the system can be applied to the process manually or automatically via the existing SCADA system. In any case tne process will run as close to the theoretical optimum as is practically possible.

Fuzzy-Logic

The result of the design of a fuzzy-logic system is mathematically identical to the result of the design of a fuzzy controller. (Technically speaking both methods result in a statical non-linear characteristic diagram. In contrast to the ANN, which “learns” independently from historical data, the fuzzy system must be designed explicitly. This is done by the formulation of “if-then-else-rules”. So called linguistic variables are used to do the design, which serves the human way of reasoning.

„Conventional“ Technologies

It´s self-explanatory that we are as well competent in using all necessary conventional technologies, such as automation-technology, SCADA systems and database technology.

Benefits / Advantages

Because of the model-design in the run-up of the project, we have good security concerning the achievability of the project targets. Hence the project risk is reduced significantly.

Due to the data-driven method, the results are much closer to the theoretically achievable optimum than with an empirical concept like fuzzy-logic.

The necessary effort for the realization of the complete solution is dramatically lower compared to a conventional solution based on physical models (ASM, …). Therefore the economical efficiency is extremely high.

The patented procedure SecurityNet assures the information about the validity of each prediction the model generates.

Benefits

Your benefits are based on significant savings of energy consumption, chemicals and a bigger security in complyin to the given threshold values. These are partly obliged by law. By analyzing the data of your plant we can calculate the economical potentials that are achievable:

- Reduced concentrations of pollutants
- Better compliance to threshold values
- Reduced consumtions of chemicals
- Reduced consumption of energy
- Increased security

Free of charge and without obligation we analyze your plant by generating a test model, which can give you quantitative information about your special economical potential. Please contact us!

References

The references of our partner ATLAN-tec GmbH in water processes but also in other industrial processes (chemical, pharmaceutical) show the far spreading and the large potentialof our technologies:

ABB AG, Mannheim
AEW-Plan GmbH, Köln
Akzo Nobel AG, Obernburg
Bachofen AG, Uster (CH)
Babcock Anlagenbau GmbH, Oberhausen
BASF AG, Ludwigshafen
Bayer AG, Dormagen
Bayer AG, Krefeld
Bayer AG, Leverkusen
Beiersdorf AG, Hamburg
Biochemie GmbH, Kundl (A)
Boehringer Mannheim, Penzberg
BSL Olefinverbund AG, Merseburg
Celanese GmbH, Werk Ruhrchemie, Oberhausen
Cerestar Ltd., Manchester (GB)
CIBA Spezialitätenchemie GmbH, Lampertheim (D) + Pratteln (CH)
Condea Chemie GmbH (RWE-DEA), Brunsbüttel
Daimler-Benz AG, Hamburg
Degussa AG, Hanau
Deutsche Babcock Anlagen GmbH, Oberhausen
Deutsche EXXON Chemical GmbH, Köln
Deutsche Shell AG, Köln
Dr. Karl Thomae GmbH, Biberach
EFFEM GmbH, Verden
Elektromark AG, Hagen
Elenac GmbH, Werk Wesseling
ENKA GmbH & Co.KG, Heinsberg
Erasmus Universität Rotterdam
EUDIG AG, Dillenburg
EWE AG, Oldenburg
Heidelberger Zement GmbH, Heidelberg
Heineken BV, Zoeterwoude (NL)
Henkel KGaA, Düsseldorf
Hoechst Research & Technology GmbH & Co.KG, Frankfurt
Hoffmann-La Roche AG, Grenzach-Wyhlen
Hüls Infracor GmbH, Marl
ICA GmbH, Hannover
InfraServ GmbH & Co.KG, Wiesbaden
Intersnack GmbH & Co.KG, Köln
ISW, Wädenswil (CH)
Keller GmbH, Ibbenbüren
Kerr-McGee Pigmente GmbH & Co.KG, Krefeld

KHD GmbH, Köln
Klöckner Möller GmbH, Bonn
Krupp Uhde GmbH, Dortmund
Leybold Systems GmbH, Hanau
Merck KGaA, Darmstadt
MiRO Mineralöl Raffinerie GmbH & Co.KG, Karlsruhe
Mercedes Benz AG, Bremen
NGW Niederrheinische Gas- und Wasserwerke, Duisburg
NIS GmbH, Hanau
OWA Odenwald Faserplattenwerke GmbH, Amorbach
Peroxid-Chemie GmbH, Pullach
Polymerlatex GmbH & Co.KG, Marl
Rheinische Olefinwerke GmbH, Wesseling
Raffinerieverband Vohburg Ingolstadt (RVI, BP, AGIP)
RWE Energie, Wesseling
Sachtleben Chemie GmbH, Duisburg
Sartorius AG, Göttingen
Schering AG, Bergkamen + Berlin
Solvay Deutschland GmbH, Hannover
STEAG u. VEW oHG, Bergkamen
Stockhausen Chemie GmbH & Co.KG, Krefeld
Sycon GmbH, Schwalmtal
TDE GmbH, Durmersheim
Wacker Siltronic AG, Burghausen
Waeschle Maschinenfabrik GmbH, Ravensburg
Witco GmbH, Bergkamen

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