Oral Discussions on Session: "Dynamics and Control" – Part II

Edited by Costas Vournas and Tasos Bakirtzis

Chair: Pete Sauer (University of Illinois)

Abstract

This paper contains the second part of the transcribed oral discussions of Session "Dynamics and Control" of the 2013 IREP Symposium-Bulk Power System Dynamics and Control, held on Monday morning, August 26, 2013. Papers [1]-[4] were presented.

Discussion

Chair: I was going to ask someone if we can use wind turbines as braking fans. Someone was looking for braking resistors, but braking fans sound more practical. You can do something with them. I don't know.

Dionysis Aliprantis (Purdue Universty): I have a question for Mikael Wämundson [2]. You were looking at the fault ride-through of a big thermal generator. I think you solved the problem of the main alternator, but the thermal power plant is a very complicated facility and it has many other things connected, like pumps and so on. So, if a fault happens, and these pumps happen to stall or something like that, is there concern for the fault ride-through for a big thermal power plant?

Mikael Wämundson (Gothia Power AB): Yes, of course there is concern for the internal system and one should be aware that three-phase faults close up is not a usual problem for a thermal plant or any generator, because this is the least probable fault. Even for faults some kilometers away from the plant it is not necessary because of the impedance existing between fault and generator you ride through the fault. But during the fault itself your question is: is this the main problem, or it will disconnect because of internal problems? It should cope with this internally for a fault like this. Whatever the reason for disconnection is, whether it is pump stalling or something else, it should be investigated also.

D. Aliprantis: Maybe I could follow up. I happen to be a member of this electric machinery committee in the IEEE that just met at Vancouver. These are the guys who ran these big power plants basically and they are very concerned about this voltage ride-through regulation mainly coming from the system side. For instance, a nuclear power plant will never be able to ride-through a fault. They'll never gonna sign. These engineers will never sign anything like that. It is never going to happen. So I just needed to hear something from the people here. Whether this is a feasible thing to ask from a big thermal power plant.

M. Wämundson: The question was to the audience.

Ian Hiskens (University of Michigan): I can comment on that from my industry days actually, which goes back some distance there. We had a three-phase fault, which they never occur of course, except when they do, and was not that far from a 2x350 MW plant and everything went fine, except that one contact, one relatively small conductor on one relatively small pump tripped, which caused a cascade within the power plant and the whole 700 MW was tripped. Yes, these things never happen, except when they do…

(Laughter)

Goran Andersson (ETH): I have two questions for the first presentation by A. Adrees [1]. Very interesting and I wonder if you made any analysis concerning the influence of the power direction on the damping.It is well known from LCC HVDCs that inverters and rectifiers have a quite different influence on the damping. The second question goes in line or is a follow-up to what Ian Hiskens said yesterday about the modeling. You used Digsilent I think for your simulations. How confident are you that it's modeling these things accurately? It is well-known that SSR is very difficult to model accurately. Then I have a comment also and that is on the TCSC. I browsed quickly through your references and saw that a very good paper is missing: by Lennart Ängquist, and a colleague to Mikael Wämundson sitting up there, Massimo Bongiorno, who actually analyzed the TCSC very much in details and I recommend you to have a look on that paper. Thank you.

Atia Adrees (University of Manchester): Yes, LCC it adds negative damping, it is well known, but you will see

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that only 2-3 papers have done an SSR analysis with it and most of these come to the same conclusion, but they do it in a radial network. What was the purpose of this paper [1] was to investigate the phenomena in large network and my results kind of complimenting the results which were obtained in the previous papers that VSC controls introduce negative damping as compared to LCC, but they can also add positive damping. But again, this damping is not significant and cannot make an unstable system become stable. Yes, I use Digsilent for my studies, but the models I use are not the built ones. We have built these with the help of my sponsors, National Grid, so indeed they are not the built-in models in Digsilent.

Anthony Papavasiliou (Catholic University of Louvain): We've seen in our simulations that must-take renewables are detrimental for operating costs and we see some hundred dollars negative prices in some parts of the US, because of wind power production. I am wondering if these resistors that you use for fault ride-through can be loaded for a while, so that you can actually have, like you said, big heaters that can improve the operating costs instead of just loading them for a few milliseconds.

M. Wämundson: Yes, of course, it is possible to use the heat but since these faults occur perhaps every one in ten thousand years it will not be well- invested money to make use of this heat.

A. Papavassileiou: The thing is, you can avoid shutting down a unit, I mean avoid disturbing operation, by increasing the load, and make a few hundred dollars per hour while you are at it. So I am wondering if you can load, if it is technologically feasible to load these resistors for long times.

M. Wämundson: We haven't investigated that. I think, though, that as a nuclear plant has a very high demand in security, I don't know if you would be able to make use of such a device that is connecting resistors in series with a nuclear power plant, because it would increase security risks for the nuclear power plant. It could be a fault in the resistor and the whole plant could be disconnected and I don't know if they are willing to take that risk.

Costas Vournas (NTUA): My question is for the Swissgrid paper by Iason Avramiotis [3]. It seems a little strange that you use continuous AGC control, which means that you send continuous signals to generators and so on. I believe that the practice is that you send signals at discreet times and you also keep a deadband – you don't bring ACE exactly to zero, because loads are changing all the time. In the simulation, of course, you have only one disturbance and everything is fine. So, I would like to ask whether you have considered to have a discrete type of system, with a deadband and see if your model predictive control can work in this case.

Iason Avramiotis (Swissgrid): Well this was an initial study, let's say, to make a suggestion if this scheme tackles the problem so regarding the modeling, if we see something, we'll consider to do as a follow-up study.

Georgios Tsourakis (NTUA): For Dr. Farantatos [4]. It was nice to see Evangelos attacking questions that so many people in the world have on short-circuit contribution. As I remember from the literature survey, when I was finishing my PhD some people said that the wind turbines, for example double-fed machines, can operate fast after the first transient, after a few cycles they can go back to normal operation even with low voltage. Have you considered this?

Evangelos Farantatos (EPRI): When you say normal operation with what control action?

G. Tsourakis: Normal control action. The converter resumes control of the current.

E. Farantatos: Basically with the models we have we can simulate that. If this is something that can be done, it can be implemented as a control in the models and check what the short-circuit contributions are in that case. The question is what control the vendors are doing, what the vendors want to do.

G. Tsourakis: OK we can discuss it off-line.

Louis Wehenkel (University of Liege): I have a quick question for the braking resistor paper [2]. In practice how would you trigger the opening and closing of this breaker in an optimal way, what kind of measurements would you use to make it work in a robust fashion?

M. Wämundson: In the investigations we have done we thought of an implementation of a distance relay looking out at the outgoing lines for a certain distance. If a fault occurs in this critical distance, which we have to investigate first when we need to activate this braking resistor, it will be activated by opening this breaker you saw, the one short-circuiting the braking resistor. That's the simplest implementation, with a breaker in parallel with a braking resistor. So, you can open it with a communication and breaking time, overall time of 60 milliseconds. Also the implementation includes protection relays that are already there and uses them to trigger the breaker. I don't know if I answered your question.

Louis Wehenkel: About the closing?

M. Wämundson: Well the closing, we haven't figured out if we are to use some kind of variable braking times, or rather we look at some fixed braking time and after a definite time you will close the breaker again. After 200 milliseconds the breaker will be closed again.

Chair: I have a story I always tell in my class about the Swiss. I am going to check to see if it is really true. I tell them that during the night they buy cheap nuclear power from France. They pump water up into the Alpes and then the next day, when it is very hot they let the water come down and they sell it to the Germans. Is that true?

Alex Papalexopoulos (ECCO International): Yes it is true.

Athanasios Troupakis (Swissgrid): And to Italy.

Chair: And to Italy? Very good. So I will expand my story now. Ok, if there are no further questions I think our session is near the time limit and we can adjourn for lunch.

Chair: This was the last question. I would like to thank all authors and discussers.

References

[1] A. Adrees and J. Milanovic, "Study of Subsynchronous Resonance in Meshed Compensated AC/DC Network," Bulk Power Systems Dynamics and Control – IX (IREP), August 25-30, 2013, Rethymnon, Crete, Greece.

[2] M. Wämundson, S. Lindahl, J. Hagman, D. Johansson and F. Heyman, "Dimensioning of EHV Series Braking Resistor for Large Thermal Generators," Bulk Power Systems Dynamics and Control – IX (IREP), August 25-30, 2013, Rethymnon, Crete, Greece.

[3] I. Avramiotis-Falireas, A. Troupakis, F. Abbaspourtorbati and M. Zima, "An MPC Strategy for Automatic Generation Control with Consideration of Deterministic Power Imbalances," Bulk Power Systems Dynamics and Control – IX (IREP), August 25-30, 2013, Rethymnon, Crete, Greece.

[4] E. Farantatos, U. Karaagac, H. Saad and J. Mahseredjian, "Short-Circuit Current Contribution of Converter Interfaced Wind Turbines and the Impact on System Protection," Bulk Power Systems Dynamics and Control – IX (IREP), August 25-30, 2013, Rethymnon, Crete, Greece.