

Francesc Casanellas

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1968 to 1984. Mecanica Moderna, S.A., company dealing in power transmission.

Starting as engineer for sales support, later as managing director, I started the new electronic department and designed and directed the manufacturing of:

- DC drives, up to 90 kW
- AC drives (three phase inverters) up to 11 kW: the first to be manufactured in Spain, using thyristors first, bipolar transistors later.
- Electronic tachometers, panel mounting and hand held (contactless).
- Speed controls and magnetic pickups for ships and submarines (EN Bazán).
- Speed and position controls for automobile and glass factories as: Citroën, Renault, Ford, Saint Gobain, etc.

1985 to 1992. Novat, S.A. As managing director (I owned 51 % of the shares, the rest belonging to a venture capital company) and chief design engineer.

- Range of three phase AC drives from 0.37 to 90 kW using MOSFETs and IGBTs.
- Special AC drives for conveyors and escalators of the new Djakarta airport (CNIM-Aéroport de Paris)
 - Self tuned a.c. drives (these were the first self tuned a.c. drives in Europe): sold under the makes Novat (in Spain), CEGELEC (Alcatel) in UK, Rotrac in Holland, etc.
 - Inverter to drive the compressor of refrigerators for cars and ships (Electrolux).
 - Automatic control of a warping machine using a computer, an interface electronic with microprocessor, 2 stepper motors and a main 22 kW inverter.

I-1993 to I-1994. Heenan Drives Limited, Worcester, England

This company bought my previous company Novat and as part of the deal, employed me in a 2 year contract as a Research and Development Engineer.

Design of:

- Switched mode power supplies for inverters.
- New dead time compensation system for three phase inverters.
- Computer program and simulation algorithms to calculate the switching losses of IGBTs in three phased inverters.
 - Three phase inverters up to 315 kW.
 - Small, low cost, pump inverter drive.
 - Hybrid (switched + linear) 750 W power amplifier with very low distortion and phase shift, for Schlumberger Industries.
 - New control strategy for a fast response three-phase front end converter for power factor unity, regenerative. Simulation program.

1995 to 1997: ALP, S.C. , again in Spain working in my own design company.

- Three phase portable phantom load generator with voltage (0- 3x 320 V) and current (0-3x100A) switched mode amplifiers, with very low distortion, supply 50 to 500 V (for Schlumberger Industries).
- Switched mode power supply fed from 1500 V (Heenan Drives).
- Three phase generator, distortion < 0.1%, 0-550 V, to test electric relays (for ENDESA the major electric company in Spain).
- Automatic control of an electric locomotive, microprocessor driven with about 40 inputs and 40 outputs. For RENFE (the Spanish rail company).
- Special DC drives for a glass factory. (Asea Brown Boverly).
- Power unit with 2500 W 310 V to 24 V converter and two 3.5 kW three-phase inverters (for the pneumatic and the hydraulic pumps) for a hybrid bus. (Delphi (General Motors), Luxemburg. Electric Vehicles Int., Calif.)
- 400 W ultrasonic generator using a resonant inverter and with automatic tuning (Industrias Esteves).
- 15 kV isolation amplifier for locomotives (RENFE, the Spanish rail company).
- Switched mode, 700 W modular battery chargers (Alcatel).
- Three phase inverter with control included, for automatic doors (Controlsa)
- Special power supplies (Powerbox).

From 1998. FACOMSA

- Electronic dashboards for motorcycles (for Honda, Peugeot, Piaggio, Yamaha, etc).
- Electronic dashboards for cars (Santana, Iveco).
- Battery regulators, flashers.
- Low cost capacitive level gauge with output simulating a variable resistor.
- Wireless speed sensor for motorbikes, without battery.

From 2010. Consultant engineer.

- LED lamps for traffic lights (Vitri).
- Chloride and pH controls for swimming pools (BSV Electronic), including the power supply and the controller. Range from 15 to 200 g/l.
- Motor supervisor (underload, overload, phase sequence, etc.) (BSV Electronic).
- Power supplies for traffic lights (TACSE).
- Chlorinators for swimming pools, using electrolysis. Power converter up to 5400 W and the control board. (BSV).
- High accuracy, low cost, conductivity sensor to measure salt concentration (BSV).
- Electronic loads for converters (BSV).

Some papers:

“Teoria de los variadores Diferenciales” (Theory of differential variators), DYNA (review of the Spanish Association of Engineers), November 1974: This papers deducts equations to estimate powers and torques of differential mechanisms driven with variable speed.

“Calculo de los elementos pasivos de conmutación en un inversor con SCR” (Calculus of passive elements of an inverter using SCR), Mundo Electrónico, 1984, no. 44. Full analytical analisis of McMurray and Burgunm-Nyhof inverters and deduction

of equations to compute commutating capacitors and chokes or to deduct the commutated current from the components. (Note: up to then there was only the McMurray system using graphics)

“Perfil de velocidad óptimo para posicionamiento” (Optimal profile for positioning), *Automática e Instrumentación*, 1990, no. 208. Shows different speed/distance functions for positioning and deducts the optimal speed profile, shows how to calculate motor temperature, etc.

“Losses in PWM inverters using IGBTs”, *IEE Proceedings of Power Appl.* Vol. 141, no. 5, September 1994. Analytical deduction of the calculation of forward and switching losses of an inverter using PWM.

"Compensación del Tiempo Muerto y de los Retardos en Inversores y Amplificadores de Potencia Clase D". *Elektor*.

"High voltage, simple and fast inverter". *Electronics World*, november 2003.

"Circuit makes simple high-voltage inverter", *EDN*, May 27, 2004.

"Quasiresonant converter uses a simple CMOS IC", *EDN* April 15, 2004.

"Digitally programmable resistor serves as test load". *EDN*, March 3, 2005.

"Sencillos Circuitos para Electrónica de Potencia". IEEE seminar. Seminario anual de automática, electrónica industrial e instrumentación, Universidad de Oviedo, 2006.

“Calculation of the passive components and the commutating current in an assisted turn off inverter.” IEEE seminar. Seminario anual de automática, electrónica industrial e instrumentación, Universidad de Oviedo, 2006.

"Power supply meets automotive-transient voltages specs". *EDN*, Sept. 18, 2008.

“ Σ - Δ Isolation amplifier transfers low frequencies across barrier”. *EDN*, August 2013.

“Water and vandal-proof keypad uses piezoelectric disc as sensor and buzzer”. *EDN*, April 2014.

“New slope compensation method stabilizes switches”. *EDN*, March 2016.

Patents:

- Very simple high voltage inverter, US patent 4802075, 1988
- Self tuning system for three-phase variable frequency inverters, Spanish pat. 9003250, 1990.
- Voltage control system for low voltage three-phase inverters, protecting an inverter designed for Electrolux (based on an asymmetrical modulation scheme). Spanish pat. 9199950, 1991
- Hybrid (switched + linear) power amplifiers, applied by my customer Schlumberger, European patent 94400486.0, 1994).
- Microstepping driving system for stepper drives used in dashboards, Spanish pat. 9903259.
- Capacitive level gauge (refers to a very simple circuit which measures accurately the capacity and simulates a resistive gauge), 2005.
- Wireless self supplied speed sensor for motorbikes, 2005.
- LED lamp for traffic lights, 2006.