FINCAD: Multi-Asset Derivatives Analytics
Innovative, integrated and versatile

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For 28 years, FINCAD has been honing and refining its enterprise-level portfolio analytics and risk system with extensive market coverage, flexible modelling choices, high-speed calculation capabilities, and scalable technology that foster coordination between quants and developers, and between front and middle offices.

Seasoned hedge funds and start-ups alike are gravitating to FINCAD F3, which has special appeal to some macro, fixed income and relative value traders who require more breadth of coverage and greater granularity in valuation methods.

FINCAD's client base numbers over 800 and reaches into the whole financial ecosystem of buy side, sell side and related service providers. The roster spans hedge funds, asset managers, insurers, pension funds – such as First National Swedish Pension Fund, central banks, banks (with some in Japan, Turkey, Latin America), auditors such as KPMG, administrators Prescient Fund Services and Viteos, pricing services agencies such as Nordic Bond Pricing and exchanges.

Asset management clients named in press releases include CarVal Investors, State Street Corporation, Morgan Stanley, Aberdeen Asset Management and Ashburton Investments. FINCAD's website contains multiple case studies of how clients are using the software to streamline their investment, valuation, and risk processes.

FINCAD's DNA is derivatives analytics. The firm was founded in 1990 with a mission to provide valuation and risk analytics for derivatives, putting the buy side on a level playing field with the sell side, and in 2018 received *The Hedge Fund Journal*'s award for 'Best Derivatives Valuation and Risk Solution'.

FINCAD can be used to value a wide variety of plain vanilla and more exotic derivatives, including Barrier, Binary, Bermuda, Cliquet, Multi-Asset, Naked, Napoleon, Power, Quanto, and Rainbow options (and various combinations thereof); cross currency swaptions, Dim Sum bonds, Hybrids, Inflation Index Linked Swaps, Range Accrual Notes, and Snowballs. Valuation methods and inputs can include Monte Carlo simulations, models of stochastic volatility such as Heston or SABR, and multiple curves involving risk free interest rates, inter-bank interest rates, swap rates, inflation indices and so on. FINCAD's suite of valuation methods can help users to comply with US GAAP and IAS accounting standards on fair valuing derivatives; with AIFMD valuation and EMIR derivative trade reporting.

For OTC derivatives, which will tend to be classified as level 2 or level 3 assets for valuation purposes,

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valuation subjectivity goes with the territory, so it is vital for users and other interested parties to have confidence in the analytics being used. FINCAD strives to be at the leading edge of derivatives valuation. "FINCAD Analytics Suite, which launched in 1996, was the first commercially available, multi-asset derivative pricing library that we are aware of. The library was built to cover all asset classes, including rates, bonds and foreign exchange," says Vice President of Product Management and R&D, James Church.

FINCAD has continued to innovate as the financial markets have evolved, bringing its clients the benefits of working with a vendor that offers a developed product, sold under a subscription model, along with professional services for configuration and customization. This is essential since Church estimates that the total cost of ownership for in-house software is 20% initial development and 80% ongoing maintenance, partly because the systems need to keep pace with evolving financial markets. "In the 1990s, it was quite innovative to value interest rate swaps with an Excel add-in," says Church. Today there are many more considerations when managing a multi asset class portfolio, and FINCAD F3 was designed to take on these challenges. In the post-crisis era, FINCAD could quickly support its clients with multi curve valuation following the move to index swap (OIS) curve discounting, and has easily adjusted to negative interest rates. "For example F3 did not need any extra work to handle negative rates due to its fundamental flexibility. It took us half a day to support shifted log normal modelling for negative

rates. Looking to the future, we are well-placed to help our clients through the end of LIBOR, given our ability to flexibly model multiple interest rate curves as best practice evolves," points out Church.

FINCAD's own bench of quants have financial market experience. The firm also draws on academic expertise. John Hull, Professor of Derivatives and Risk Management, and Alan White, Peter L. Mitchelson/SIT Investment Associates Foundation Chair in Investment Strategy and Professor of Finance, both at the Rotman School of Management at the University of Toronto, have contributed to FINCAD's blog and videos discussing developments such as OIS discounting and modelling negative rates.

Building bridges amongst quants, developers, portfolio managers, traders and risk managers
A harmonised API for all users – including FINCAD itself – is appreciated by all. The Excel version shares the same API as the developer version, which has open architecture letting developers use their favourite programming languages (such as Java, Net, Python and C Sharp). MATLAB versions are also available. This facilitates a constructive dialogue between quants and developers. "We want to get analytics into the hands of as many people as possible. Developers and quants do not always understand each other, and few people have both skillsets. We provide the infrastructure to let quants and developers share the same data and analytics, so that quants can solve analytics problems and developers can focus on integration, without each having to know both worlds," says Church. The fact that FINCAD uses the same API as its clients, not only expedites routine technical support, but also helps to drive forward ongoing improvements, such as a work-flow, web-based UI added in 2016.

Joined up thinking within client firms extends to the full life cycle of the investment management process, from idea generation, to execution and risk management. Quants can do back-testing and find mispricings, then traders using the same analytics can scour the markets for the anomalies and use pre-trade risk management outputs such as P&L, VaR, sensitivities, cash-flow forecasts, liquidity measures and scenario stress tests, to help size positions appropriately. Post-trade analytics including P&L attribution are also part of the package.

Enterprise-level development: build or buy?
Firm-wide cross-fertilisation of ideas is encouraged by current FINCAD releases. Having started out with a single user desktop model, F3 now spans firms' front through to middle offices, thus

reducing reconciliation activity, and covers whole portfolios. "Managers need VaR at the portfolio level as well as at the trade level," says Church.

'Build or buy' is one of the eternal debates of software and Church has seen some managers regret DIY development, partly due to mixing disparate development environments. "Managers have mixed databases, Python coding, Visual Basic and Excel, which can make it hard to get a common view across the business," says Church. Operationally, a hosted system can also be simpler to work with. "Our web-based cloud offering is better than installing software and hardware locally. It is hard and expensive to maintain software systems," explains Church.

Hedge funds are searching for new sources of yield and diversification, and breadth of market coverage helps to determine their choice of software provider, according to FINCAD's Global Head of Marketing and Corporate Communications, Rob Garfield. Managers expanding into new markets prize the extended market coverage offered by FINCAD, which includes markets such as interest rate volatility (swaptions, caps, floors, and skews), mortgage volatility, swap curves and tenor basis-adjusted swap curves, in over 30 currencies. FINCAD has for instance authored a guide on the special valuation nuances around Brazilian bonds, swaps and inflation-linked bonds. FINCAD's analytical capabilities include hedging mortgage-backed securities and derivatives, using behavioural models from AD&Co and Intex to forecast prepayments, defaults and cash-flow waterfalls.

Three recent client wins illustrate what hedge funds and their technology staff are looking for. After broadening its own investment universe, an emerging markets manager determined that FINCAD would be superior to continuing with its own in-house systems. Another client widening its market horizons has chosen to continue a former relationship with FINCAD; the CTO was a FINCAD client at their previous firm. "This fund wants to apply their investment expertise to new markets. After evaluating options, they said we were by far the best, saving them an incredible amount of time in terms of being plugged in to industry-standard models and best practice curves," says Church.

For start-ups with no legacy systems, time is of the essence, and many simply do not have the bandwidth to reinvent the wheel and build their own analytics software. The devil is in details "such as holiday conventions, rate curves, inflation curves, and cross currency models, which are a huge undertaking even for the largest and most liquid 30 financial markets," says Church.

Women in finance and technology

FINCAD's wider involvement in the investment and technology industries is demonstrated by an annual Women in Finance scholarship for graduate level study, which can be applied for on the FINCAD website. This marks a small step towards addressing the persistent and marked disparity between the genders in finance and technology. Says FINCAD co-founder, President and CEO, Bob Park, "not enough women around the globe are pursuing an education in quantitative finance or software engineering, particularly at the post graduate level."

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Additionally, FINCAD can provide end of day and intraday risk reports, where some advanced analytical features come into play.

Accelerated computational capabilities
FINCAD's next generation analytics library, FINCAD F3, launched in 2010, includes a feature, Algorithmic Differentiation (AD), which Church describes as revolutionary. "It calculates sensitivities, scenarios and valuations simultaneously, at a very small computational cost, and saving a huge amount of time. For a complex portfolio it can be thousands of times faster than bumping curves," says Church. This is particularly useful for intraday calculations. Like machine learning, AD dates back to the

1950s, having applications in diverse fields such as engineering and oceanography, and has more recently been applied to finance. FINCAD has patented Universal Algorithmic Differentiation™ namely the way in which the design of the analytics library makes AD universally available throughout, so that particular valuation models can be applied to particular instruments. "We have taken the expertise in tier one banks and built the library from the ground up. Hitherto, AD had been applied in a more piecemeal fashion," says Church.

Versatility and flexibility
The omnipresence of AD in the library is one dimension of its versatility. "The library has incredible flexibility. It can snap together financial contracts like Lego building blocks. Single cash-flows or legs of cash-flows can be combined to represent almost any financial product. Users can also customize market definitions, and even create their own, which matters because modelling some markets is as much an art as a science. There is flexibility to define large numbers of curves and vol surfaces to handle the complexity of multi-asset class, and multi-currency, portfolios. Moreover, the dependency graph between curves is managed by F3, resulting in more efficient calculations and removing a common source of errors when modelling markets," explains Church.

Decoupling product definition from valuation methods is crucial to give quants the flexibility and freedom they need, for example, to use different swap valuation methods – and decompose where differences of opinion about valuation are coming from. "One of our global macro hedge fund clients builds very detailed models to seek out mispriced bonds and interest rate markets. Trading is so competitive that profits come from a tiny edge, which means traders have to be able to model the market and tweak models to get valuations matching their exact view. Industry standard terminals are not transparent or flexible enough for more sophisticated analytics," says Church.

FINCAD is not only sold on a standalone basis. The FINCAD Alliance programme allows for collaboration with other software providers and service providers. For instance, Black Mountain has integrated FINCAD F3 into its Everest Solution and Kinetix Trading Solutions uses FINCAD for pre-trade verification.

As some hedge fund strategies perceived to be easily replicable through alternative risk premia strategies are seeing pressure on fees, hedge funds need to differentiate their offering through trading more exotic and esoteric markets and instruments. This demands that service providers such as FINCAD are on the same wavelength. **THFJ**