CLAIMS

What is claimed is:

1. A system of pricing options, the system comprising:

a storage to store trade information corresponding to one or more underlying assets;

a memory previously having stored pricing-module instructions; and

a processor to execute the pricing-module instructions resulting in a pricing module, the pricing module configured to execute the steps of:

receiving first input data corresponding to at least one parameter defining a first option on an underlying asset;

selecting and reading from the storage second input data including trade information corresponding to at least one current market condition relating to said underlying asset;

determining, based on said first input data and said second input data, a price of the first option by the step of applying a predefined pricing calculation to the first input data and the second input data according to a predefined pricing model, wherein the step of applying the predefined pricing calculation comprises the steps of:

determining a second option representing a position opposite to a position of the first option and having a same absolute delta value as the first option; and

determining the price of the first option by satisfying a first criterion and a second criterion, the first criterion relates to a sum of a first correction corresponding to the first option and a second correction corresponding to the second option, and the second criterion relates to a difference between the first correction corresponding to the first option and the second correction corresponding to the second option,

wherein the first correction relates to a difference between the price of the

first option according to the pricing model and a theoretical price of the first option,

and wherein the second correction relates to a difference between the price of the second option according to the pricing model and a theoretical price of the second option; and

providing an output corresponding to the price of the first option.

2. The system of claim 1, wherein the first criterion requires that the sum of the first correction and the second correction is proportional to a sum of a first volatility convexity and a second volatility convexity corresponding to the first option and the second option, respectively,

and wherein the second criterion requires that a difference between the first correction and the second correction is proportional to a difference between a first delta convexity and a second delta convexity corresponding to the first option and the second option, respectively.

3. The system of claim 2, wherein the step of applying the predefined pricing calculation comprises the steps of:

setting the sum of the first volatility convexity and the second volatility convexity to be a predefined function of a volatility of the first option according to the pricing model and a volatility of the second option according to the pricing model,

and setting the difference between the first delta convexity and the second delta convexity to be a second predefined function of the volatility of the first option according to the pricing model and the volatility of the second option according to the pricing model.

4. The system of claim 2 or 3, wherein the first criterion requires that the sum of the first correction and the second correction is proportional to the sum of the first volatility convexity

and the second volatility convexity according to a first proportionality function, which is based on said delta,

and wherein the second criterion requires that the difference between the first correction and the second correction is proportional to the difference between the first delta convexity and the second delta convexity according to a second proportionality function, which is based on said delta.

5. The system of claim 4, wherein the step of applying the predefined pricing calculation comprises the steps of:

determining one or more market-based parameters based on said second input data; and

determining at least one of the first proportionality function and the second proportionality function based on a predefined combination of said delta and said one or more market-based parameters.

6. The system of claim 4 or 5, wherein the first proportionality function and the second proportionality function are decreasing functions of said delta.

7. The system of any one of claims 2-6, wherein determining the price of the first option by satisfying the first criterion and the second criterion comprises the step of determining the price of the first option by satisfying the following equations:

$$\zeta_C^{\Delta} + \zeta_P^{\Delta} = A(\Delta) \cdot Vega^{\Delta} d_1^2 \left(\frac{1}{\sigma_{K_{Call}}} + \frac{1}{\sigma_{K_{Put}}} \right)$$

$$\zeta_C^{\Delta} - \zeta_P^{\Delta} = B(\Delta) \cdot Vega^{\Delta} \frac{d_1}{S\sqrt{t}} \left(\frac{1}{\sigma_{K_{Call}}} + \frac{1}{\sigma_{K_{Put}}} \right)$$

wherein ζ_C^{Δ} and ζ_P^{Δ} denote said first correction and said second correction,

wherein Δ denotes said delta,

wherein A(Δ) and B(Δ) denote a first function and a second function of Δ, respectively,

wherein $Vega^{\Delta}$ denotes a vega of the first option and the second option,

wherein t denotes a time to expiration of said first option,

wherein d_1 denotes a predefined function of the time to expiration of said first option,

wherein S denotes a price of said underlying asset,

and wherein $\sigma_{K_{Call}}$ and $\sigma_{K_{Put}}$ denote a volatility of the first option according to the pricing model and a volatility of the second option according to the pricing model, respectively.

8. The system of any one of claims 1-7, wherein said pricing module is to determine said first correction based on the first criterion and the second criterion, and to determine the price of said first option based on the first correction and said theoretical price of the first option.

9. The system of claim 8, wherein said pricing module is to determine a volatility of the first option based on the first criterion and the second criterion, and to determine said first correction based on the volatility of the first option.

10. The system of any one of claims 1-9, wherein said first option and said second option include Vanilla options.

11. The system of claim 10, wherein said pricing module is to determine a price of an exotic option on said underlying asset based on the pricing model.

12. The system of any one of claims 1-11, wherein said first input data comprises an indication of at least one parameter selected from the group consisting of a type of said first option, an expiration date of said first option, a trigger for said first option, and a strike of said first option.

13. The system of any one of claims 1-12, wherein said second input data comprises an indication of at least one parameter selected from the group consisting of a spot value, a forward rate, an interest rate, a volatility, an at-the-money volatility, a delta risk reversal, a delta butterfly, a delta strangle, a 10 delta risk reversal, a 10 delta butterfly, a 10 delta strangle, a 25 delta risk reversal, a 25 delta butterfly, a 25 delta strangle, a caplet, a floorlet, a swap rate, a security lending rate, and an exchange price.

14. The system of any one of claims 1-13, wherein said pricing module is to provide an output based on the price of the first option.

15. The system of claim 14, wherein said pricing module automatically submits a bid price and/or an offer price of said first option according to said pricing model based on a change in said second input data.

16. The system of any one of claims 1-15, wherein said underlying asset comprises a financial asset.

17. The system of any one of claims 1-16, wherein said underlying asset is related to at least one asset type selected from the group consisting of a commodity, a stock, a bond, a currency, an interest rate, and the weather.

18. A computer-based method of pricing options, the method comprising the steps of:

receiving, by a computing device, trade information corresponding to one or more underlying assets;

storing said trade information in storage means;

receiving, by the computing device, first input data corresponding to at least one parameter defining a first option to be priced on an underlying asset;

selecting and reading, by the computing device, second input data from the storage means, the second input data including trade information corresponding to at least one current market condition relating to said underlying asset; and

determining, by the computing device, based on said first input data and said second input data, a price of the first option by the step of applying a predefined pricing calculation to the first input data and the second input data according to a predefined pricing model, wherein the step of applying the predefined pricing calculation comprises the steps of:

determining a second option representing a position opposite to a position of the first option and having a same absolute delta value as the first option; and

determining the price of the first option by satisfying a first criterion and a second criterion, the first criterion relating to a sum of a first correction corresponding to the first option and a second correction corresponding to the second option, and the second criterion relating to a difference between the first correction corresponding to the first option and the second correction corresponding to the second option,

wherein the first correction relates to a difference between the price of the first option according to the pricing model and a theoretical price of the first option,

and wherein the second correction relates to a difference between the price of the second option according to the pricing model and a theoretical price of the second option; and

providing, by the computing device, an output corresponding to the price of the first option.

19. The method of claim 18, wherein the first criterion requires that the sum of the first correction and the second correction is proportional to a sum of a first volatility convexity and a second volatility convexity corresponding to the first option and the second option, respectively,

and wherein the second criterion requires that the difference between the first correction and the second correction is proportional to a difference between a first delta convexity and a second delta convexity corresponding to the first option and the second option, respectively.

20. The method of claim 19, wherein the step of applying the predefined pricing calculation comprises the steps of:

setting the sum of the first volatility convexity and the second volatility convexity to be a predefined function of a volatility of the first option according to the pricing model and a volatility of the second option according to the pricing model,

and setting the difference between the first delta convexity and the second delta convexity to be a second predefined function of the volatility of the first option according to the pricing model and the volatility of the second option according to the pricing model.

21. The method of any one of claims 18-20 including the step of automatically submitting a bid price and/or an offer price of said first option according to said pricing model based on a change in said second input data.

CLAIMS

What is claimed is:

1. A system of pricing options, the system comprising:

a memory having stored thereon pricing-module instructions; and

a processor to execute the pricing-module instructions resulting in a pricing module configured to receive first input data corresponding to at least one parameter defining a first option on an underlying asset and second input data corresponding to at least one current market condition relating to said underlying asset, and, based on said first and second input data, to determine a price of the first option according to a volatility smile satisfying a first criterion relating to a sum of a first correction corresponding to the first option and a second correction corresponding to a second option representing a position opposite to a position of a the first option and having substantially a same absolute delta value as the first option,

wherein the first correction relates to a difference between a theoretical price of the first option and the price of the first option according to the volatility smile, and wherein the second correction relates to a difference between a theoretical price of the second option and the price of the second option according to the volatility smile.

2. The system of claim 1, wherein the first criterion requires that the sum of the first and second corrections is proportional to a sum of first and second volatility convexities corresponding to the first and second options, respectively,

and wherein the second criterion requires that a difference between the first and second corrections is proportional to a difference between first and second delta convexities corresponding to the first and second options, respectively.

3. The system of claim 2, wherein the sum of the first and second volatility convexities is a predefined function of a volatility of the first option according to the volatility smile and a volatility of the second option according to the volatility smile,

and wherein the difference between the first and second delta convexities is a second predefined function of the volatility of the first option according to the volatility smile and the volatility of the second option according to the volatility smile.

4. The system of claim 3, wherein the first criterion requires that the sum of the first and second corrections is proportional to the sum of first and second volatility convexities according to a first proportionality function, which is based on said delta,

and wherein the second criterion requires that the difference between the first and second corrections is proportional to the difference between the first and second delta convexities according to a second proportionality function, which is based on said delta.

5. The system of claim 4, wherein at least one of the first and second proportionality functions includes a predefined combination of said delta and one or more market-based parameters, and wherein said pricing module is to determine said market-based parameters based on said second input data.

6. The system of claim 4, wherein the first and second proportionality functions are decreasing functions of said delta.

7. The system of claim 2, wherein the first and second criterion require satisfying the following equations, respectively:

$$\zeta_C^{\Delta} + \zeta_P^{\Delta} = A(\Delta) \cdot Vega^{\Delta} \, d_1^2 \left(\frac{1}{\sigma_{K_{Call}}} + \frac{1}{\sigma_{K_{Put}}} \right)$$

$$\xi_C^{\Delta} - \xi_P^{\Delta} = B(\Delta) \cdot Vega^{\Delta} \frac{d_1}{S\sqrt{t}} \left(\frac{1}{\sigma_{K_{Call}}} + \frac{1}{\sigma_{K_{Put}}} \right)$$

wherein ξ_C^{Δ} and ξ_P^{Δ} denote said first and second corrections,

wherein Δ denotes said delta,

wherein A(Δ) and B(Δ) denote first and second functions of Δ, respectively,

wherein $Vega^{\Delta}$ denotes a vega of the first and second options,

wherein t denotes a time to expiration of said first option,

wherein d_1 denotes a predefined function of the time to expiration of said first option,

wherein S denotes a price of said underlying asset,

and wherein $\sigma_{K_{Call}}$ and $\sigma_{K_{Put}}$ denote a volatility of the first option according to the volatility smile and a volatility of the second option according to the volatility smile, respectively.

8. The system of claim 1, wherein said pricing module is to determine said first correction based on the first and second criterions, and to determine the price of said first option based on the first correction and said theoretical price of the first option.

9. The system of claim 8, wherein said pricing module is to determine a volatility of the first option based on the first and second criterions, and to determine said first correction based on the volatility of the first option.

10. The system of claim 1, wherein said first and second options include Vanilla options.

11. The system of claim 10, wherein said pricing module is to determine a price of an exotic option on said underlying asset based on the volatility smile.

12. The system of claim 1, wherein said first input data comprises an indication of at least one of a type of said first option, an expiration date of said first option, a trigger for said first option, and a strike of said first option.

13. The system of claim 1, wherein said second input data comprises an indication of at least one of a spot value, a forward rate, an interest rate, a volatility, an at-the-money volatility, a delta risk reversal, a delta butterfly, a delta strangle, a 10 delta risk reversal, a 10 delta butterfly, a 10 delta strangle, a 25 delta risk reversal, a 25 delta butterfly, a 25 delta strangle, a caplet, a floorlet, a swap rate, a security lending rate, and an exchange price.

14. The system of claim 1, wherein said pricing module is to provide an output based on the price of the first option.

15. The system of claim 14, wherein said pricing module is to communicate said output via a communication network.

16. The system of claim 1, wherein said underlying asset comprises a financial asset.

17. The system of claim 1, wherein said underlying asset is related to at least one of a commodity, a stock, a bond, a currency, an interest rate, and the weather.

18. A computer-based method of pricing options, the method comprising:

receiving, by a computing device, first input data corresponding to at least one parameter defining an option to be priced on an underlying asset and second input data corresponding to at least one current market condition relating to said underlying asset; and

based on said first and second input data, determining by the computing device a price of the option according to a volatility smile satisfying a first criterion relating to a sum of a first correction corresponding to a first option and a second correction corresponding to a second option representing a position opposite to a position of a the first option and having substantially a same absolute delta value as the first option,

wherein the first correction relates to a difference between a theoretical price of the first option and the price of the first option according to the volatility smile, and wherein the second correction relates to a difference between a theoretical price of the second option and the price of the second option according to the volatility smile.

19. The method of claim 18, wherein the first criterion requires that the sum of the first and second corrections is proportional to a sum of first and second volatility convexities corresponding to the first and second options, respectively,

and wherein the second criterion requires that the difference between the first and second corrections is proportional to a difference between first and second delta convexities corresponding to the first and second options, respectively.

20. The method of claim 19, wherein the sum of the first and second volatility convexities is a predefined function of a volatility of the first option according to the volatility smile and a volatility of the second option according to the volatility smile,

and wherein the difference between the first and second delta convexities is a second predefined function of the volatility of the first option according to the volatility smile and the volatility of the second option according to the volatility smile.

21. The method of claim 20, wherein the first criterion requires that the sum of the first and second corrections is proportional to the sum of first and second volatility convexities according to a first proportionality function, which is based on said delta,

and wherein the second criterion requires that the difference between the first and second corrections is proportional to the difference between the first and second delta convexities according to a second proportionality function, which is based on said delta.

22. The method of claim 21, wherein at least one of the first and second proportionality functions includes a predefined combination of said delta and one or more market-based parameters, the method including determining said market-based parameters based on said second input data.

23. The method of claim 21, wherein the first and second proportionality functions are decreasing functions of said delta.

24. The method of claim 19, wherein the first and second criterion require satisfying the following equations, respectively:

$$\xi_C^{\Delta} + \xi_P^{\Delta} = A(\Delta) \cdot Vega^{\Delta} d_1^2 \left(\frac{1}{\sigma_{K_{Call}}} + \frac{1}{\sigma_{K_{Put}}} \right)$$

$$\xi_C^{\Delta} - \xi_P^{\Delta} = B(\Delta) \cdot Vega^{\Delta} \frac{d_1}{S\sqrt{t}} \left(\frac{1}{\sigma_{K_{Call}}} + \frac{1}{\sigma_{K_{Put}}} \right)$$

wherein ξ_C^{Δ} and ξ_P^{Δ} denote said first and second corrections,

wherein Δ denotes said delta,

wherein $A(\Delta)$ and $B(\Delta)$ denote first and second functions of Δ, respectively,

wherein $Vega^{\Delta}$ denotes a vega of the first and second options,

wherein t denotes a time to expiration of said first option,

wherein d_1 denotes a predefined function of the time to expiration of said first option,

wherein S denotes a price of said underlying asset,

and wherein $\sigma_{K_{Call}}$ and $\sigma_{K_{Put}}$ denote a volatility of the first option according to the volatility smile and a volatility of the second option according to the volatility smile, respectively.

25. The method of claim 18, wherein said first and second options include Vanilla options.

26. The method of claim 25 including determining a price of an exotic option on said underlying asset based on the volatility smile.

27. The method of claim 18, wherein said first input data comprises an indication of at least one of a type of said first option, an expiration date of said first option, a trigger for said first option, and a strike of said first option.

28. The method of claim 18, wherein said second input data comprises an indication of at least one of a spot value, a forward rate, an interest rate, a volatility, an at-the-money volatility, a delta risk reversal, a delta butterfly, a delta strangle, a 10 delta risk reversal, a 10 delta butterfly, a 10 delta strangle, a 25 delta risk reversal, a 25 delta butterfly, a 25 delta strangle, a caplet, a floorlet, a swap rate, a security lending rate, and an exchange price.

29. The method of claim 18 including providing an output based on the price of the first option.

30. The method of claim 18, wherein said underlying asset comprises a financial asset.

31. The method of claim 18, wherein said underlying asset is related to at least one of a commodity, a stock, a bond, a currency, an interest rate, and the weather.